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OBSERVATIONS

ON THE

DIAGNOSIS

OF

PULMONARY TUBERCULOSIS.

BY

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1925

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There seems to be little doubt that a great many of the diagnoses made in practice are wrong. Especially is this so in the case of slight ailments where the symptoms are mainly subjective. It is often impossible to be certain of the cause of these symptoms, and a tentative diagnosis only can be made. But even in serious complaints mistakes are made by skilled diagnosticians, as is proved by the unexpected findings on exploratory operation and on post-mortem examinations. Medicine is not yet an exact science, but with greater knowledge and experience on the part of the practitioner, it becomes more and more exact, and mistakes are less frequent.

Now in slight complaints it may not matter very much to the patient when the wrong cause is ascribed to the symptoms troubling him, but in the case of suspected Pulmonary Tuberculosis it is of paramount importance that a correct diagnosis be made, because of all that depends upon it. When the disease is present, it ought to be diagnosed so that the patient be put on the right lines of treatment, and when it is not present, it is a blunder of some magnitude to say that it is, because of all that is entailed by the labelling of a case as suffering from that disease; for when a case is notified, this means, for the majority of the population, unless in very advanced cases, treatment at a Sanatorium, at the expense of the State or Local Authority. It means also considerable anxiety to the patient and his friends, and, unfortunately after discharge from the Sanatorium, it means in some cases difficulty in getting

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employment, because of the stigma which is attached to the disease. This stigma is still very real. I had a patient some time ago, who, after discharge, was banned, by the directors of the firm with whom he worked, from returning to his employment. This was a fairly early case of real Pulmonary Tuberculosis. He tried to obtain employment with three other firms in succession. He was asked with what firm he had been previously, and when he had left their employment. What had he been doing since, was the next question, to which he replied that he had been in a Sanatorium, and at once they declined to proceed any further.

It is, therefore, of most vital interest to one's patient that a correct diagnosis should be made of the disease, if it is present, and that it should not be diagnosed if absent. Some practitioners, who realise the importance of early diagnosis, are inclined to notify cases on insufficient grounds, and others again, through incomplete and hurried examinations, or through fear of making a mistake when the disease is not really present, wait far too long.

In the Sanatorium here both types of case are frequently admitted. On the one hand there are patients who have been suffering for a long time from most suggestive symptoms, such as haemoptysis, attacks of pleurisy, even ischio-rectal abscess. Only a week ago a patient was admitted who gave a history of all three and who, on physical and X-ray examination, presented extensive signs of disease in both lungs. This case, though under medical supervision for many months, had only recently been diagnosed. On the other hand there are cases, who present only a few indefinite symptoms, no physical or X-ray signs, and in

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whose case it can only be said that there is a slight suspicion, This latter type should be kept under observation, and careful examinations made at frequent intervals, until something really definite is found. Then only should a diagnosis be made and notification take place.

For purposes of diagnosis it is necessary first of all to go into the health history of the patient himself, his family history, especially with reference to tuberculosis, and the symptoms of the present illness. History of pleurisy, and any spitting or coughing up of blood are very important. It should also be noted whether there has been any other manifestations of tuberculosis, as may be indicated by scars in the neck due to old tubercular glands.

In the case of family history one should enquire whether the patient was actually in contact with a case at any period of his life, especially during childhood. In some cases with a positive family history, this will be found to be so, but in others the only family incidence has been in relatives who, perhaps, have died before the patient was born, or who never, at any time, came into contact with him. In the latter instance, the family history is not so important.

Now in the case of pleurisy and haemoptysis, it is well to remember that all pleurisies and all haemoptyses are not due to Pulmonary Tuberculosis, but at the same time that most are.

SYMPTOMS.

HAEMOPTYSIS: - Haemoptysis when the blood is bright red and frothy, or when some blood is coughed up, and for the next day or two the sputum is blood stained, is nearly always due to tuberculosis, but streaking of the sputum may be due to

/bronchitis.

bronchitis. True haemoptysis occurs in mitral stenosis, and abscess of the lung. In a case of the latter I had in the Sanatorium, post-mortem examination in the hospital where he died, subsequently revealed an abscess at the base of the right lung where dullness and weak breath sounds with occasional bronchial breathing had been detected (No X-ray examination was then obtainable). There were also two abscesses in the brain, one in the frontal lobe, and a small one at the tip of the occipital lobe. In this case, the sputum was very foetid, there was haemoptysis on three occasions, the amount varying from three to six ounces, the signs were basal, and no tubercle bacilli were found in the sputum.

Another form of blood spitting which is confused with haemoptysis due to Pulmonary Tuberculosis, is the thin watery blood coughed up in some cases of hysterical young women. In these cases the type of patient and character of the blood make one suspicious. The haemorrhages are often frequent, but generally small in amount, and are kept up for long periods of time, but the patient does not seem any the worse. I have had two such cases, one of them under observation for about eight months, and although the blood was brought up daily, sometimes for weeks, no physical signs were ever detected. Some of these haemorrhages are undoubtedly fraudulent, but I was unable in these two cases to detect any local lesions in the mouth to account for them. Some authors would class them as cases of vicarious menstruation, whilst others cast doubt on the existence of such a condition.

There are many other causes of haemoptysis but apart from tumour of the lung, they are not likely to give rise to difficulty.

PLEURISY: - A history of so called idiopathic pleurisy should certainly raise suspicion that the underlying cause is tuberculosis. Thirty to forty per cent are followed later by a definite lesion of the lung. Repeated attacks of pleurisy increase the suspicion and an effusion, unless it be due to heart or kidney disease, makes the diagnosis almost certain. Indeed in many of the cases of effusion I see at the Sanatorium there are definite signs of a pulmonary lesion as well. The pulmonary lesion is present sometimes on the same side and sometimes on the opposite side. Where there is a scar showing that an excision of a rib has been performed for empyema it is important to get an exact history. Most of these cases are subsequent to pneumonia. Cases of tubercular empyema generally show definite disease in the lung, and when following a rupture of the lung there is air as well as pus in the pleural cavity.

ISCHIO-RECTAL ABSCESS: - Another common history is that of ischio-rectal abscess. This usually occurs after the case is moderately advanced, but there are some cases in whom it is one of the early symptoms that an infection with tuberculosis has taken place. Some of my cases have been in-patients who have been admitted with well marked signs of Pulmonary Tuberculosis and have subsequently developed an abscess when in the Sanatorium. Others on admission are already suffering from fistulae, and one was sent in with that diagnosis alone, but on examination signs of pulmonary disease were detected at the left apex.

COUGH: - The great majority of cases complain of cough. Some at first do not admit cough, but on cross-examination will say that they have had a cough but nothing to take any notice of, or that they cough, but no more than other people. Some
/patients

patients are much less conscious of their own symptoms than others. It is found that the cough at first is generally dry, and only after a period does the patient begin to bring up sputum. Some will say that they have been troubled with repeated colds for a long time, but in the intervals they feel quite well until they catch one cold that does not clear up. In cases associated with bronchitis there is a history of winter coughs for a number of years which used to become easier in the summer or entirely disappear. In these cases the cough is specially troublesome and paroxysmal in character. Others have a cough after which they vomit. In some this occurs on waking in the morning. In these there is an associated chronic gastritis; but others again cough soon after a meal and bring up some of the food they have recently swallowed. It is to the latter type that the term emetic cough has been applied (see Fishberg) and it is said when not due to whooping-cough or alcoholic excess it is pathognomonic of Pulmonary Tuberculosis. A great many cases have little trouble with cough. In these there is a cough on waking up in the morning and they are clear of it for the rest of the day, and they cough again on lying down in bed at night, but are not troubled through the night. Others are troubled at intervals during the day and night as well, and a few suffer from frequent cough both day and night.

As mentioned above, the cough nearly always precedes the sputum for a period, so that a number of the patients who present themselves for examination have cough but no sputum. When sputum occurs it is generally pigmented and mucoid at first, and only later becomes muco-purulent. In some cases there is a good deal of froth mixed with the mucopurulent sputum. In these there is an associated bronchitis.

DYSPNOEA: - Dyspnoea, subjective or objective has been a very common symptom in my cases. Some patients are less sensitive to this symptom also than others, for they say that they do not feel short of breath, but the examiner readily sees that the respirations are rather more rapid than normal. I have been surprised at the frequency of this symptom, even in cases where not much of the lung parenchyma is involved. In these cases it is no doubt toxæmic in origin.

LOSS OF APPETITE AND LOSS OF WEIGHT: - In most of my cases there have been both ^{loss} of appetite and loss of weight. In some there has been loss of weight, but no appreciable loss of appetite. In none is there loss of appetite without loss of weight. This might conceivably occur where there is retention of fluids in the body owing to kidney disease. I had a case in the Sanatorium where this actually occurred. The patient had a poor appetite and was steadily losing weight, when suddenly he began to gain weight. This synchronized with a new line of treatment which had been adopted, and at first it was thought that the gain in weight was due to it. Very soon, however, it was discovered that his legs were beginning to swell, that the face was becoming oedematous, and on examining the urine a large quantity of albumen was found together with waxy casts and the amount of urine passed was greatly diminished.

There is often a history of capricious appetite, some days good and some days bad.

A history of indigestion has not been common, though a certain number of cases have suffered therefrom, even those in an early stage of the disease. This generally takes the form of fullness after meals with some flatulence, but nothing more serious as a rule.

HOARSENESS: - Hoarseness of the voice apart from tubercular laryngitis occurs occasionally, and less frequently aphonia at intervals. The latter is more often found in women.

Sometimes the very first symptom of which the patient takes notice is hoarseness, and in these cases the larynx is generally affected with tuberculosis, but in nearly all cases there is at the same time a demonstrable lesion in the lung when the cases reach me. I had, however, one case in a boy of twelve who had been seen by a laryngologist, and sent in with a tubercular larynx, whose lungs showed very little except a slightly impaired note at one apex. There was no sign of active disease except in the larynx where the true cords were definitely eroded.

In the cases with dysphagia due to tubercular ulceration of the epiglottis there were well defined signs of Pulmonary Tuberculosis as well.

FATIGUE OR TIRED FEELINGS: - Some authors refer to this as the earliest of signs. In my experience though a very common and early symptom, quite a number of definite cases deny having experienced these feelings. Here again the variable degree of appreciation of symptoms on the part of patients has to be taken into account. Most patients who note these feelings state that they begin to get tired before the end of their day's work and feel exhausted by the time they get home.

NIGHT SWEATS: - Night sweats are fairly common. In a large proportion of my cases they are complained of as having occurred at some time or other apparently during some more acute exacerbation of the disease. They are quite frequently present in cases giving a recent history, and in patients with only slight signs. In children they should not be confounded

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with the night sweating that occurs in rickets. The time of the occurrence and the part of the body affected differ in the two diseases. In rickets the sweats occur early during sleep and are confined to the head and upper part of the chest, whereas in tuberculosis they occur in the early morning.

BLOOD PRESSURE: - I have made a number of observations on the blood pressure in cases of Pulmonary Tuberculosis and find, as was to be expected, very great variations in the readings. They vary in different subjects, owing to differences in age, as in health.

Method of taking the blood pressure - I use a Tyco's sphygmomanometer which has been tested against a Riva Rocci mercurial manometer to ascertain that the readings on the dial of the Tyco's are accurate. The blood pressure on both arms is taken. The auditory method controlled by the tactile is used for the systolic, and the auditory alone for the diastolic. The point at which the clear sound of the third stage (Oliver) suddenly ceases and is followed by a dull and faint sound which ultimately entirely disappears, is taken as the diastolic.

Many fallacies have to be guarded against. In nervous patients, and there are many amongst the sufferers from tuberculosis, the heart acts forcibly, and both systolic and diastolic are apt to be too high. In these patients the first reading is discarded. It is found that the reading of the first side examined is considerably higher than on the second, but when the observation is repeated on the former, there may be a considerable drop so that the two are almost identical. For comparative readings the position of the patient and the time of taking should be the same. Readings should not be taken after meals, baths, exercise. I have frequently found

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that the readings on the two arms vary considerably (from five to fifteen mm.) and vary similarly in the same person on different days. When this occurs there are three possible explanations; -

- (1) The artery on the side showing the lower pressure is smaller than the opposite side, a developmental asymmetry.
- (2) Some pressure on the large arteries the innominate or sub-clavian allowing less blood to get through.
- (3) A contracted brachial which makes it more difficult to compress and obliterate the pulse wave.

The latter is the explanation put forward by Oliver to explain a marked difference of pressure on the two sides.

On the whole the results of my observations on blood pressure are that there is a tendency for the blood pressure to be reduced in Pulmonary Tuberculosis, and that low pressures are more frequently found the more advanced the cases are, and the more severe the toxæmia, but this is not by any means invariably so, and the blood pressure readings alone cannot be taken as an infallible guide in judging the severity of the case. In the majority of early cases it is normal; in a few, decidedly below normal. In the medium stage cases, there is a higher percentage of low readings, and in the advanced cases, the highest of all. In some of these, the systolic reading may be as low as eighty. It is not safe, however, in doubtful cases, to rely too much on the blood pressure readings in coming to an opinion. Some writers advocate acceptance of an otherwise doubtful case if the blood pressure is low, but until it is known what are the limits of the normal, this is inadvisable. That there are considerable differences in healthy people of the

same age seems certain (Mackenzie and Oliver) and unless one has happened to know from a previous examination what the normal for any particular individual is, (and this is uncommon) it is unwise to lay much stress on a blood pressure which is ten to fifteen mm. below an arbitrary standard of normal for individuals of a certain age.

PULSE: - The study of the pulse is of value in the diagnosis of Pulmonary Tuberculosis. In the early cases, and in young adults in particular, it tends to be unstable, and only a slight stimulus is necessary to raise the rate. Any excitement such as coming before the doctor for examination or for blood-pressure readings, may raise the pulse which, after rest, is eighty to ninety, to one hundred and twelve to one hundred and twenty. This instability is most noted in young adults with a fairly recent history, and in whom the active process has not been going on long enough for a tolerance to the toxins to be established. In middle-aged people even with a short history it is not so often found, and in chronic cases going on for years, it is often absent. In the latter, however, especially in disease on the left side, it may be an important feature even with a normal temperature. This instability of the pulse may not be indicated on the pulse chart, if the observations are always made after rest, but not infrequently a pulse over ninety with a normal resting temperature is noted. Fishberg states that the pulse-rate is invariably raised in early Pulmonary Tuberculosis. This is not the case in my experience, and it is surprising sometimes how slow the pulse-rate is even during attacks of pyrexia, though as a rule the pulse rises simultaneously. Of course in cases with continuous fever, or hectic fever, the pulse is invariably raised. There seem as Pottenger observes, to be two types

of individual, one in whom the sympathetic dominates the vagus, and the other in whom the vagus dominates the sympathetic. In the former there is apt to be a rapid pulse with a toxæmia of slight degree, and in the latter, a moderately slow pulse with greater toxæmia.

THE TEMPERATURE: - Mouth or rectal temperatures are alone reliable for detecting the relatively small variations from the normal which may be present in Pulmonary Tuberculosis, and the rectal is more reliable than the mouth, as it does not depend so much on outside factors, such as the temperature of the air, or hot or cold fluids recently in contact with the mucous membrane. Greater precautions have to be taken with mouth readings than with rectal, and for routine procedure the latter is used unless there is some definite contra indication as, fistula, fissure, piles, or other local disease of the rectum. It is important, however, that the patient should understand how to insert the thermometer, as in one case I had recently who was registering a very subnormal temperature, it was discovered that she was inserting the wrong end.

It is generally stated that there is a difference of from $.5^{\circ}$ to 1° in the readings taken in the mouth and the rectum, and this I have found to be correct. The temperature of a healthy adult generally ranges from 97° - 98.4° in the mouth, and from 97.6° - 99° in the rectum. In the morning before breakfast and before rising it is, as a rule, at its lowest, and in the afternoon between three and six p.m. at its highest. Exercise produces a rise in temperature in the healthy, but this as a rule disappears after from half to one hour at rest. Between the morning and the evening temperature there is a gap of from $\frac{1}{2}^{\circ}$ - $1\frac{1}{2}^{\circ}$. Anything wider than that, if repeated, is accepted as an abnormality of the temperature.

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Now it cannot be absolutely stated that the figures given above (98.4° in the mouth and 99° in the rectum) are normal for all persons. Some have a slightly subnormal normal temperature, and others a slightly supernormal normal temperature, taking the above figures as the normal. This specially applies to women. The temperature in women apparently healthy is more unstable than in men. There are greater variations from the figures given above. In many women there is what is called a premenstrual rise in the temperature. In these there is a rise of $.5^{\circ}$ - 1° during the week or fortnight before the onset of menstruation, and at the onset of menstruation the temperature falls to normal. The premenstrual rise is often most marked in the morning temperature, which shows a curve about 1° above the normal morning reading, whilst the evening temperature is only $.5^{\circ}$ above normal. In other women there is no pre-menstrual rise but at the onset of menstruation there is a slight rise of temperature for a day or two. Nervous women also show often marked variation from the normal curve, which can only be accounted for as being a manifestation of neurosis.

There are other pathological causes for an abnormal temperature in the course of Pulmonary Tuberculosis than the disease itself. Any chronic focus of infection in the tonsils, sinuses, nasopharynx, teeth, intestines, bronchial tubes or pelvic organs in women may be the cause of low pyrexia. These have to be kept in mind and looked for, and abnormal readings not always ascribed to tuberculosis suspected or proved on other grounds to be present.

Some authors assert that there is practically always some elevation of the temperature in active Pulmonary Tuberculosis. This is not always reflected in the routine night and morning

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temperature charts in a Sanatorium, though it generally occurs. The explanation of this is probably that the rigid rest enforced at first in these cases produces a different curve from that which would be present were the patients allowed to be up and taking exercise. The great majority of the early cases, however, even at rest, show a slight elevation of the temperature though it may only be $\frac{1}{2}^{\circ}$ - 1° and this, after a varying period of rest in bed, in some a few days, in others weeks or months, declines to the normal. There are some cases, however, who pass through long periods of active disease, when the disease, as shown by physical signs, is gradually spreading from apex to base, who show practically no deviation from the normal. I had a patient under observation for nearly five years. At the beginning of that time there were signs of disease at the left apex to the second rib in front and the spine of the scapula behind. The area of dullness and crepitations gradually extended until the whole of that lung was involved, and not until the last six months was there any constant pyrexia. There were from time to time at varying intervals short periods of slight pyrexia, but with rest in bed these quickly subsided. In this case, in spite of a normal temperature and pulse, and gain in weight and the retention of the gain for a time, the signs gradually spread. There were always also cough and sputum, and tubercle bacilli were found at every examination, so that there could be no doubt of the activity of the process. Until about the fourth year this patient always looked and felt fairly well, and, as I said, retained the weight he originally gained.

Others again, in whom there are signs of fairly widespread disease, involving perhaps both lungs, show a subfebrile type of chart. The rectal evening temperature runs between 99° - 100°

or slightly over. In some of these, if one looks at the chart as a whole, one will note that there are periodic waves of a higher and lower degree of fever. In these patients this type of chart indicates slowly progressive disease. Rest in bed gradually produces a reduction, and in some a decline to the normal takes place. If, after several months, the temperature is still up at rest, I observe the effects of allowing the patient up gradually, and, if there is no increase, gradually get him up all day; and in some I find that a little exercise instead of raising the temperature brings it down, occasionally to normal.

Where the disease is advancing rapidly, the temperature is generally high. There may be continued fever where the readings are high both night and morning. This is found in Miliary Tuberculosis, and in the Acute Pneumonia and Broncho-Pneumonic type of disease. In others, whilst the evening temperature is high, the morning frequently descends to normal or considerably below normal, these steep falls during the night being generally accompanied by profuse night sweats. This is thought by many to be typical of mixed infection in cavities which are increasing in size; whilst others hold that the absorption of tuberculosis and protein toxins during the breaking down and liquefaction of the caseous masses is sufficient to account for it.

Another type of fever found in Pulmonary Tuberculosis is the Inverse type in which the morning temperature is higher than the evening temperature. In this the readings may only be slightly above normal, but from the signs, (decline in weight and strength) there is clearly an advancing process.

On the whole I have come to the conclusion in observing over 1,000 cases at the Sanatorium, a considerable proportion

of which are observation cases and never develop any definite symptoms or signs, that a temperature of between 99° and 100° at night in the rectum frequently occurs in the absence of Pulmonary Tuberculosis, and that Pulmonary Tuberculosis may be present in its early stages, without anything but occasional rises beyond the 99° limit.

But, after all, symptoms only lead one to suspect the presence of Pulmonary Tuberculosis. They do not prove it. No one symptom taken by itself is pathognomonic of the disease. Each symptom is common to several other diseases. Haemoptysis is the one symptom which points most strongly to Pulmonary Tuberculosis but, as already shown, an absolute reliance on this is wrong. All the symptoms must be considered together with the history. The greater the number of the above symptoms which are present, the more likely is Pulmonary Tuberculosis to be the underlying cause.

All symptoms are not of equal value. They may be classified as suggested by Pottenger into those due to :-

- (1) the tuberculosis process per se;
- (2) toxæmia; and
- (3) a reflex cause,

and, if some of the symptoms out of each group are present, suspicion becomes greater than if all the symptoms belong to two or one group.

Next to haemoptysis in order of importance I should put history of pleurisy, cough, tired feelings, loss of weight, dyspnoea.

The more advanced the disease is, the greater are the number of symptoms. It is, however, a sound rule not to make the diagnosis until one's suspicions are confirmed by the examination of the chest. This must always be the next step and should be

/done

done systematically.

INSPECTION.

This is of very great value, and the greater the experience of the physician, the more he is able to learn from it. The state of nutrition of the muscles attached to the bony thorax should first be noted. The shape of the chest and its movements should be next observed. There is no one type of chest characteristic of the disease. Pulmonary Tuberculosis may occur in a chest of any shape. The so called normal, the alar chest, the flat chest, the rachitic chest, the pigeon chest, the barrel shaped chest are the common varieties, and Pulmonary Tuberculosis may or may not be present in whatever kind presents itself.

More important than the type of chest is the presence of any asymmetry of the two sides; localized hollowings, flattenings, bulgings have to be noted. Hollowing above one or both clavicles, flattening below, the hilus dimple, which is a localised recession on inspiration in the second space near the sternum, bulging or indrawing of the interspaces, drooping of the shoulder, narrowing of the supraclavicular area as compared with its fellow,, flattening of the trapezius and lowering of the trapezius angle when viewed from behind, the position of the scapulae, whether they are on the same level and equidistant from the vertebral column, greater prominence of the muscles over the base of the lung posteriorly on one side or the other, have all to be looked for. Marked deformities of the chest must be noted, as they greatly alter the findings on percussion and auscultation.

Hollowing above one clavicle with slight flattening below and flattening in the supraspinous area is frequently seen.

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This merely means that there has been a chronic affection of the corresponding apex with some shrinkage thereof at some period, and does not necessarily mean active disease at the present time. It should be noted, and its proper significance assessed later on.

There are many healthy people with considerable flattening of one side of the chest. Many of these are due to a congenital malformation. That they are not due to underlying tuberculosis of the lung can be readily proved by percussion, which gives a resonant note. Such a degree of flattening, if due to tuberculosis, would cause a very definite impairment in the percussion note.

There is sometimes hollowing of both supraclavicular areas in healthy persons. This occurs in those who are not accustomed to much exercise and are shallow breathers. The elevated clavicles in emphysema also produce this appearance of hollowing. Flattening below the clavicle is sometimes due to congenital atrophy or absence of the pectoral muscles on the one side. Drooping of the shoulder may be due to occupational causes or to scoliosis. One sometimes finds that in cases with this sign, who have really got Pulmonary Tuberculosis, the signs on percussion and auscultation and shadows on the X-ray plate are on the opposite side. The hilus dimple is not very frequently seen, but is said to indicate old healed disease.

Localized indrawing of the intercostal spaces indicates an adherent pleura. Very often a general indrawing of the spaces, chiefly laterally, accompanied by sucking in of supraclavicular and epigastric area is seen, but this is characteristic of bronchitis and emphysema rather than tuberculosis. In the disseminated nodal type, however, there is very frequently in-

/drawing

drawing of the lateral intercostal spaces on both sides, though percussion and auscultation may show very little in these areas. The skiagram, however, clearly shows the nodes scattered throughout both lungs.

The standing out of muscles owing to increased tone should be noted. This will be referred to again under palpation.

In watching the expansion of the chest during quiet and forced inspiration, any difference in amount of expansion on the two sides or any lagging, may help greatly in the diagnosis. The defect in expansion may involve the whole of one side or be strictly limited. When the whole side is involved and the expansion absent, or almost absent, pleurisy with effusion or collapse of the lung following an effusion with thickened and adherent pleura, or very extensive fibrosis should be suspected. In the two latter conditions flattening and contraction of the whole side is present, whilst in the former, when the effusion is still present, there is no flattening, but on the contrary there may be bulging.

Pneumothorax also produces a similar appearance on inspection. The position of cardiac pulsation, if visible, helps to distinguish between pneumothorax and effusion on the one hand, and collapse of the lung and fibrosis on the other. In the two former the heart is pushed over to the opposite side owing to the shifting of the mediastinum towards the healthy side where the negative pressure is greater, whilst in the two latter, the heart is pulled over to the same side, owing to the contraction of the lung on that side.

Any curvature of the vertebral column should be looked for as this may account for many cases of drooping of the shoulder which one finds in actual practice, and it also alters the lie of the ribs, making their position on the two sides asymmetrical, /which

quite which/frequently explains the difference found in percussion over the slightly asymmetrical areas.

An increased area of cardiac pulsation is not always due to heart disease, but may be due to contraction of one or other lung in Pulmonary Tuberculosis. The result of this contraction is that more of the heart surface becomes superficial to the chest wall and, besides, the heart is pulled over to the diseased side. So that on inspection we may get an increased area of cardiac pulsation, and, at the same time, find pulsation in areas which the heart does not normally occupy. The greatest dislocation takes place when there is great loss of lung tissue from cavity formation. When the disease is on the left side the apex may be in the anterior axillary line or beyond it, and at a higher level than the fifth space. When it is on the right side, the right border may be several inches to the right of the sternum as made out by percussion, whilst there is cardiac pulsation in the third and fourth spaces.

In a few cases, owing to a rapid and excited heart, which is not uncommon, especially during the examination of the chest, more diffuse pulsation than normal is observed. I draw attention to this because it is not very uncommon in tuberculosis and because the observer is liable to ascribe it to a functional derangement of the heart, which in truth it is, without thinking of tuberculosis as a possible cause.

The degree of flattening, limitation of movement, etc., depends on the extent of lung area involved and on the severity of the lesion. An infiltration will produce much less change on inspection than a cavity or consolidation. When there are only a few scattered tubercles there may be no change on inspection. Anything more than slight hollowing above or below

the clavicle and slight limitation of movement means that the incipient stage is passed. Lagging is said by most authors to ~~produce~~ ^{precede} either of these signs. In my cases it has been almost always accompanied by some degree of limitation of expansion as well.

Limitation of movement must also be looked for at the base of the lung. This indicates either an effusion or pleural adhesion following an effusion with some collapse of the lower lobe, or a chronic interstitial pneumonia, or tuberculosis of the lower lobe. In an effusion there may be some increase in size of the affected side, if the effusion is large enough. The other conditions will as a rule produce more or less contraction.

PALPATION.

Palpation confirms much of what has already been made out on inspection. Differences in expansion on the two sides or lagging can often be more readily determined by combining inspection and palpation. The two hands are placed symmetrically on either side of the chest, and the differences in movement are both seen and felt. In doing the apices I use the method, generally described, of standing behind and placing the thumbs touching each other over the first Dorsal Spine, and the fingers over the anterior aspect of the chest below the clavicle, the palm resting on the curve of the trapezius. A similar method is used for the bases of the lungs, the thumbs touching each other at the level of the lower end of the sternum, the fingers curving round the lateral aspects of the chest. In palpation to test expansion, the hands should be placed lightly and equally on the chest, as firm or unequal pressure will vitiate the findings.

findings.

By palpation also the condition of the skin and muscles is investigated. When there is much wasting the skin is dry and can readily be lifted up in folds. General wasting of muscles can be better appreciated, and localized wasting or tonicity observed on inspection is confirmed. Pottenger lays great stress on the importance of palpation, and claims to be able by palpation of the ex-ternal wall of the thorax to determine the condition of the lung inside. I have not been able to confirm his findings in this respect, but he has done considerable service in drawing attention to the localized wasting of muscles found over areas of chronic disease, and to the increased tone present over areas of active disease. General and localized wasting have, of course, been accepted and described by others. The value of Pottenger's work is in his insisting that the localized wasting of muscles we see in Pulmonary Tuberculosis means chronic disease which may or may not be, at the present moment, active. These wastings at an apex, especially above the clavicle, which involve, chiefly, the trapezius, sterno-mastoids, and the scaleni, or of the pectorals below the clavicle, are found quite frequently in perfectly healthy people. They are also very frequent in Pulmonary Tuberculosis which is active, and indicate that the disease has been going on for a considerable time or that there has been a recrudescence of disease in an old focus. In really early active disease Pottenger states that an increased tone of the muscles is present, and that it is this increased tone which is responsible for the lagging at that stage. This should certainly be looked for and is found occasionally, but I must confess that I have not found it as frequently as Pottenger's

book would lead one to suspect. Fishberg has noted that in the majority of early cases there is already some wasting which he explains as meaning that most cases of active tuberculosis of the lung are due to reactivity in an old focus.

By palpation also one can sometimes feel a thrill due to coarse rhonchi or friction. The heart's apex should also be accurately determined by this method where possible.

Tactile vocal fremitus due to vibrations transmitted to the chest wall from the air in the lungs during speech is a sign greatly commended by some, but I find it of less value than vocal resonance, an increase or diminution of which occurs under the same conditions as an increase or diminution of vocal fremitus, and I do not employ it as a routine in my examinations.

PERCUSSION.

Percussion in the diagnosis of disease in the human body is a particular method of striking or tapping that portion under consideration.

TECHNIQUE OF PERCUSSION:- Many different methods have been in vogue since percussion was first practised. It was first used in the diagnosis of pulmonary diseases by Auenbrugger, a physician in charge of the Spanish Military Hospital in Vienna. The immediate method of percussion, i.e., striking the part under examination immediately without the interposition of a pleximeter, was that advocated by him in 1755. Priory, about the beginning of the 19th century, introduced the mediate method. He used as a pleximeter an oval piece of ivory one and a half to two inches in diameter, and one-sixth of an inch in thickness.

/Later

Later on still the finger-finger method was introduced, and this is the one now almost everywhere in use. The writer uses, like most other physicians of the day, the middle finger of the right hand as the striker, or percussor, and the middle finger of the left hand as a pleximeter. This he places in light apposition with the part under examination, the palmar surface towards the patients. If the area is large enough the whole finger distal to the first interphalangeal joint is so placed; if smaller, as in the case of the supraclavicular area, that portion distal to the second interphalangeal joint. The essential thing is that the part of the finger struck viz, the terminal phalanx, should be in apposition with the part under examination. A number of authors insist on the need for firm application of the finger. (Guy, Halliday, Sutherland, Kingston, Fowler). Powell and Hartley, say it should be applied accurately and with sufficient firmness. On the other hand, Crockett says it should be placed on the chest wall lightly, if percussion is to be made lightly, or firmly, if percussion is to be made forcible. Riviere says that the pleximeter finger should be applied closely but lightly to the chest wall. Strong pressure with the pleximeter finger must be avoided, as this is apt to bring the inter-costal muscles into tension. Fishberg says that very light contact of the pleximeter finger with the chest wall is important; in delicate percussion the mere weight of the finger is sufficient. Pottenger advocates light touch percussion, but does not state how the pleximeter should be applied whether lightly or firmly.

I, personally, think, with Crockett, that the degree of

/pressure

pressure depends entirely whether the intention is to percuss lightly or forcibly, and in actual practice I find that the lighter the percussion is being done, the lighter is the pressure of the pleximeter; and when stronger percussion is being used, greater pressure is being applied.

Whatever method is used it is essential that the same degree of pressure should be used when comparing the note in two different areas.

THE PERCUSSOR: - The striking hand should be held in the same position as for piano playing, with neither flexion nor extension at the wrist-joint, but with the hand in the same plane as the forearm. There should also be no lateral deviation of the hand or the forearm. When the tip of the percussing finger is in contact with the dorsal surface of the phalanx to be struck there should be a very slight degree of flexion of the middle finger at the metacarpo-phalangeal joint, and the second finger flexed to just a little more than a right angle on the first, so that the terminal phalanx is vertical to the pleximeter. The other fingers and thumb are allowed to arrange themselves. Having the hand and percussing finger in the position described, one is ready to deliver the blow. This may be delivered entirely from the metacarpo-phalangeal joint, which is all that is necessary for light percussion or a combined movement at this joint, and the wrist may be employed.

The percussing finger is extended at the metacarpo-phalangeal joint according to the force required. For the lightest percussion of all the extension is sufficient if it brings the percussor about a quarter-of-an-inch away from the pleximeter. For heavier percussion a greater degree of extension is used

/and

and also a combined movement at the metacarpo-phalangeal joint and the wrist joint. Movement at the elbow and shoulder-joints is never necessary.

THE POSITION OF THE PATIENT in examination of the chest for Pulmonary Tuberculosis.

Here again different writers advocate different positions. All, however, agree that for the most accurate results it is better to have the patient standing up, or sitting in a chair, rather than lying or even sitting up in bed. The reason for this is that in conducting the examination of a patient in bed it is more difficult to apply the pleximeter finger in exactly the same way on the two sides of the chest when employing contrast percussion. It is also much less comfortable for the examiner, and any position of strain should be avoided. It is specially difficult if the patient is not able to sit up for the examination of the back, and this has to be done when he is lying on one side. This attitude itself produces a less resonant note on the side in contact with the bed, because that side does not vibrate so freely on being percussed, the vibrations being damped down by the pressure of the chest wall against the mattress. The patient should, then, whenever possible, be either standing or sitting. The head must be kept absolutely in the middle line and the arms hanging loosely by the sides. If standing, the position must be easy with the muscles relaxed, and not that of a soldier standing at attention with the chest stuck out and arms held stiffly. On percussion of the back he should stoop slightly and allow the arms to hang between the legs so as to throw the scapulae as far out as possible from the vertebral column. If the patient is sitting, it is usually better to

ask him to fold his arms, lean forward, and let the shoulders droop when one is doing the interscapular areas. In order to throw the scapula still further outwards the elbow should be raised and supported above the level of the head.

Unless the patient is feeble or too ill to stand up, I conduct my examinations with him standing. Whatever position used, he must keep the head absolutely in the middle line. Many patients in fear, perhaps, of infecting the examiner, turn their heads to the side when one is examining the apices, but this must be discouraged, for, as Pottenger puts it, "Turning the face to the opposite side throws the muscles of the neck on the stretch, which results in a higher pitched note and greater resistance to the finger."

POSITION OF THE EXAMINER:- Whenever possible it is best to keep the head at about the same level as the part under examination. This cannot as a rule be done without stooping in examining the bases of the lungs. This is uncomfortable and a position of strain and tends to distract one's attention. It is better therefore to sit, the patient being in the standing position during the examination of the lower half of the lungs, and to stand up for the upper half.

The relative heights of the patient and the examiner are, of course, the factors that bear on this matter; but the important point is that there should be no strained attitude as far as this is possible.

Whatever position the patient is in during percussion, he should breathe quietly, as the note varies slightly during the different phases of respiration. If there is any dyspnoea care should be taken that the stroke is delivered during the same

/phase

phase on the two sides, otherwise a relative dullness on one side or the other may be detected.

RESONANCE ON PERCUSSION:- The parts of the body which give a resonant note when struck are those overlying the air-containing organs in the chest and abdomen.

The note depends on vibrations set up in the chest or abdominal wall by the blow of the finger, which are conducted to the organ underneath. The contained air in the organs is then set into vibration and it is the vibration of this air which gives rise to the resonant note. When there is no air in the organ underneath, there is still a sound due to the vibrations set up in the pleximeter, and in the tissues underneath, but there is no resonance. The two classical examples of this are the notes obtained over the heart and over the liver. Over these two organs where they are superficial the note is called dull. The note, however, in percussion over the ribs is different from what it is over the interspaces and both are different from the note obtained over the clavicle. Although in all these areas the note in a normal chest is a resonant one, the part of the chest wall percussed modifies the resonant sound. In comparing the two sides therefore, one must compare rib with rib, clavicle with clavicle, and interspace with interspace. The resultant note, therefore, on percussion is due to the two factors, the chest wall or overlying tissue and the state of the pleurae and lungs beneath.

Now a resonant note varies in intensity, character and pitch. The intensity or amount of resonant sound elicited depends (1) on the force of the blow and (2) on the amount of air set into vibration, i.e., in percussing over the same area, the resonance will have greater intensity the more vigorous the

/percussion

percussion stroke used, or in percussing over different areas with the same force, greater resonance will be heard where there is more air present to be set into vibration in the organ beneath. There is a third factor also which magnifies the intensity in different areas. This is the thickness of the tissue between the fingers and the air-containing organs, e.g., with the same force there is greater resonance over the interscapular areas than in the supraspinous or infraspinous areas.

The character of a resonant note depends on the kind of tissue surrounding the air, and how the air is distributed throughout that tissue. In the healthy lung the air is surrounded by fibro-elastic septae dividing it off into numerous minute chambers. In the stomach or colon the air is in one large chamber as in a football or balloon, and is enclosed by a thin distensible wall. In the former case the resonance on percussion is called normal resonance, and in the latter tympanitic resonance. This kind of resonance has to be referred to, because in certain pathological conditions due to Pulmonary Tuberculosis, the note is tympanitic.

A note is called hyperresonant in character when there is more resonance than normal over a particular area. This is produced when the fibro-elastic tissue is thinned out, as in emphysema.

PITCH: - Resonant notes besides varying in intensity and character vary also in pitch. The pitch is due to the number of vibrations per second of the tissues and of the enclosed air. "As the amount of air in relation to the vibrating tissue is reduced the pitch is raised." (Halliday Sutherland) Consequently over any area of the lung, where there is a lessened

/amount

amount of air due to congestion, oedoeema, or partial or complete consolidation besides there being a diminution in the amount of resonance, or in the intensity of the sound, there is a raising of the pitch of the note. This change in the pitch is often more readily appreciated than the difference in the amount of resonance. Pitch is also altered by the amount of tension of the air in the part. During a deep-held inspiration the tension is increased and the pitch of the note becomes higher. Also in some cases of emphysema the pitch is high owing to increased tension of the air. In these cases there is a hyper-resonant note of high pitch which is apt to be mistaken for dullness if pitch alone is attended to. A tympanitic note also may be of high or low pitch according as to whether the air is under tension or not. In the case of pneumo-thorax with a free opening from the lung into the pleural cavity into which air passes during inspiration and out again during expiration, the note is low-pitched tympany; but if the opening is valvular and more air passes in than is able to pass out, the chest wall gradually becomes taut, and a note of high-pitched tympany results.

LIGHT OR HEAVY PERCUSSION:- The force of the blow used depends on the object aimed at. In order to detect superficial areas of disease whether it be a slightly thickened pleurae or a slight consolidation of the lung, the very lightest possible percussion should be used. The force used should just be strong enough to bring out resonance over the normal side or portion of lung and no resonance at all over the diseased area; for it is easier to distinguish between resonance and no-resonance at all than between resonance and very slightly diminished resonance which would be the difference with stronger percussion. Such

/percussion

percussion also would result in the vibrations in the chest wall spreading over a large area, and setting up vibrations in a larger area of lung which might quite well prevent a small superficial area of dullness from being appreciated at all.

For routine work in examining a chest slightly stronger percussion should be used. A stroke strong enough to bring out resonance in the normal with the head of the examiner about a foot away from the part under examination is what should be aimed at. (For the lightest percussion the ear has to be approximated closely to the part under examination). This will still be a light stroke in most areas of the chest in children and in adults who are neither muscular nor obese. In the latter case however, a still stronger stroke has to be employed to bring out any resonance at all especially posteriorly.

If in the course of the routine examination made in the manner suggested no abnormal change is found, one should then try lighter percussion to detect if possible any superficial areas missed. This should be done especially over the apices of the upper and lower lobes. If on the other hand impairment is noticed in the routine examination, stronger percussion should be tried in order to observe whether the impairment is still perceptible. This aids the examiner in deciding what is the cause ^{of} in the change in note. If there is absolute dullness on strong percussion there is fluid or complete consolidation; if there is not complete absence of resonance, but still a note which is markedly dull, there is thickened pleura, partial consolidation, or considerable fibrosis. Very light percussion is also best in marking out the borders of the lung. It is easy

to detect the passage from slight resonance to no resonance when one passes beyond the lung margin. This is especially so anteriorly and in the infra-axillae, though it is easier to note the passage from lung to heart or liver than from lung to stomach, which has also a resonant note though one of different character. The amount of force, however, necessary for this purpose, is not sufficient to detect the deep dullness of the heart and liver. The strength of the stroke has to be appreciably increased in order to do this, although a fairly light stroke is all that is required, and gives with more certainty and ease the actual position of the upper border of the liver and the left border of the heart, than the heavy percussion thought necessary for this purpose in my student days.

A similar strength of stroke is required for the detection of areas of thickened lung tissue at a similar distance below the surface. The light percussion is not sufficient to detect these any more than deep cardiac or liver dullness. For areas still deeper one should theoretically use a still stronger stroke; but owing to the lateral conduction of the vibrations it is very doubtful whether it is possible at all to detect deep disease by percussion.

REGIONAL PERCUSSION: - Percussion is commenced with the patient standing in the manner described and the examiner sitting. The lateral bases are first examined, and tidal percussion used to determine the expansion of the bases. The left base will generally be found slightly lower than the right. Tidal percussion will be described later on.

I agree with Riviere and Fishberg that it is better on the

/whole

whole to begin at the base and percuss upwards. By this method one is more likely to begin with normal resonance, and so have this normal note as a standard of comparison in one's subsequent investigations in passing higher up towards the apices. For the examination of the lateral aspects of the chest wall the patient's hands should be clasped over his head.

The infra-axillae are compared, the pleximeter finger being placed on corresponding areas on each side. It is necessary to remember that these areas do not normally give the same degree of resonance, for the liver on the right and the stomach on the left modify the note, which is somewhat higher pitched and less resonant on the right than on the left.

INFRA-MAMMARY REGION: - In the infra-mammary region again the note differs on the two sides because of the position of the heart. The area of superficial cardiac dullness should be mapped out in each case of Pulmonary Tuberculosis, as it is very often encroached upon owing to associated emphysema, or increased in size owing to contraction of the left lung from fibrosis alone, or from fibrosis and cavitation. The extent of superficial cardiac dullness is sometimes greatly increased and the heart quite superficial and pulled over to the left, even as far as the anterior axillary line, whilst the apex may be one or two spaces higher up than normal. In the case of right-sided disease the heart may be drawn over to the right of the chest and the heart dullness extend as far as the right nipple. In these cases also of extensive disease of one side with the heart pulled over to the same side, percussion often shows compensatory emphysema of the opposite lung, which fills up the space formerly occupied by the dislocated heart.

AXILLARY REGION: - These should give an identical note on each side in the normal chest.

MAMMARY REGION: - The mammae in women alter the percussion note slightly. They are not as a rule, unless large and pendulous, a source of difficulty, but one has to observe whether a slight alteration in note may not be due to some unequal development of the two glands. The pectoral muscles, especially their outer portion, diminish the resonance, and here too we have to make sure that the development of the two sides is equal.

We are now in the course of our examination approaching that part of the chest where impaired resonance is most frequently found in cases of Pulmonary Tuberculosis. These are the infra-clavicular, clavicular, and supra-clavicular areas. It is not to be inferred that the lower parts of the chest require only a cursory examination. Such a proceeding will inevitably lead to serious error, for there are cases where the only signs are at the base. These are rather uncommon, though I have met with a number. It is commoner to find when there are signs at the base, that the whole lung is diseased, and more pronounced signs still at the apex.

The infra-clavicular areas are now percussed carefully. If the patient is standing the examiner will find it convenient to stand up for this area. Indeed, except in children or in adults of small stature, he will probably have stood up for the examination of the mammary regions. The pleximeter finger must be placed parallel with the ribs, and interspace compared with interspace, and rib with rib. I generally begin at the inner end of the space and work outwards comparing corresponding areas on each side. In some cases dullness is obtained in some

part of this area although the apices appear normal, but usually when found here it extends upwards and becomes more marked over the clavicle and supra-clavicular area. It is here also, and above the clavicle that tympany from the presence of a cavity is most frequently found. The changes in percussion due to cavity will, however, be dealt with later on.

Riviere has drawn attention to the fact that above the level of the second rib the normal note is of higher pitch than over the chest below. This is important to remember, when, having discovered definite evidence of disease on one side by contrast percussion, one again percusses the opposite side from below upwards, to find out whether the opposite apex is not also affected.

Special attention should be paid to the inner ends of the first and second interspaces. When impairment is found here it is called parasternal dullness (Riviere). I have rarely, however, been able to detect this. When confined to this area alone, if not due to enlarged thymus, it indicates enlargement of the tracheo-bronchial glands. These glands are, however, seldom so much enlarged in children of school age that they give rise to definite impairment. Sometimes parasternal dullness on the left side is due to the arch of the aorta (Guy). This I was able to confirm quite recently in the case of a boy of ten, when the cause of the parasternal dullness could be demonstrated on the fluorescent screen, where one could see the pulsating aorta to the left of the sternum. In this case the whole heart was displaced to the left, and the left lung field was smaller than the right.

THE CLAVICLES: - Percussion is next done over the

/clavicles.

clavicles. If these are quite symmetrical the same note on the two sides should be obtained. Sometimes from skeletal abnormalities or from traumatic causes one clavicle is more curved or thicker than the other. These points must be noted or mistakes in the interpretation of the percussion findings will be made. The clavicles should be percussed from the junction of the middle and outer third on each side. Immediate percussion is generally used, and it should be done in finger-breadths in comparing the two sides. Normally the pitch is lower over the middle third than over the inner third, where the proximity of the trachea produces a higher pitch. In percussing over the clavicles a good ^{deal} of the sound elicited is due to the vibrations in the bone itself, much more so than in the case of the ribs, to the inner surfaces of which the lungs are closely applied.

THE SUPRA-CLAVICULAR AREA: - Above the clavicle the finger should be placed parallel to the clavicle with the tip pointing towards the middle line. Exactly the same position must be used on each side. This can be done most conveniently from behind and the side. One should first of all percuss over the true lung apex. What is its position? It passes behind the inner third of the clavicle behind the sternal and clavicular portions of the sterno-mastoid, to the level of an inch above the clavicle. According to Halliday Sutherland (page 77) the apex extends three full finger-breadths above the clavicle, and resonance gradually tails off, so that at four finger-breadths the note is quite dull. From the diagrams Halliday Sutherland uses, however, it would appear that he is not percussing directly backwards over the true lung apex behind the sterno-mastoid,

/but

but rather outside it, in which case he should obtain three finger-breadths of resonance as described. Crockett, however, states that two finger-breadths of resonance are found over the true lung apex behind the sterno-mastoid when he percusses directly backwards. Having done that, he then proceeds to percuss backwards, inwards, and downwards, above the middle third of the clavicle. In this position he says "One should be able to obtain a low pitched, resonant visicular note for about two finger-breadths, and one less so for a third."

KRONIG'S BANDS OF RESONANCE: - Kronig, in exploring the resonance at the apex, came to describe two bands of resonance, one in front above the clavicle, and one behind, above the scapular spines. The inner boundary in front extends from the sterno-clavicular articulation upwards and outwards, forming a concavity inwards, at the point where the sterno-mastoid meets the trapezius. Posteriorly the mesial boundary passes from this point inwards towards the space between the first and second dorsal spines forming a convexity inwards. The outer boundary runs from the junction of the outer and middle third of the clavicle upwards with a slight concavity outwards, crosses the trapezius about two to two and a half inches from the point where the inner boundary crosses the same muscle, and passes downwards posteriorly with a slight concavity outwards towards the middle of the spine of the scapula. These areas should be marked out with a skin pencil in all cases of suspected Pulmonary Tuberculosis. In the normal the passage from resonance to dullness is clearly defined, but as Riviere has pointed out, it has to be remembered that the pleximeter finger itself has a very appreciable width "and the whole

/breadth

breadth of the finger must cover resonance or dullness, according to the direction in which one is moving, before the edge is pencilled.¹⁶ In percussing the finger must be placed parallel to the outer and inner boundary, and when a completely dull note is obtained, the skin pencilled on the side of the finger next to the resonant area. For practical purposes the isthmus alone i.e., the highest part of the area along the upper border of the trapezius, is all that requires to be measured, and for the normal, different authors give different measurements. Riviere says that the isthmus in health is five c.m. (two inches) and should not fall below four c.m. Fishberg gives the very small measurement of two to three c.m. as being normal. Crockett says it is from two to two and a half inches. In my experience it is quite common to get a measurement of two and a half inches over a healthy apex. There is no doubt that it varies considerably according to the stature, build, and occupation of the individual. People who follow sedentary occupations and who do not take much exercise involving the need for deep breathing, are liable to have narrow isthmuses, whilst deformities such as scoliosis produce a difference on the two sides. In the latter deformity there is a lowering of the lung apex on the same side as the concavity of the curve.

In health, however, the isthmus should be equal on both sides, and when there is a distinct narrowing on one side, the assumption is that at some time or other, either now or in the past, diseased changes have produced a contraction of the narrow apex. The most frequent cause of this is Pulmonary Tuberculosis Collapse following a catarrh or a sequence of catarrhs at one

/apex

apex in some cases produces the same effect. The catarrh is often secondary to nasal obstruction and is chiefly found in mouth breathers. The collapse may terminate in fibrosis, when there will be a permanent narrowing. I have seen several undoubted cases of this condition which have been mistaken for Pulmonary Tuberculosis. Compensatory emphysema will cause an increase in the width of the isthmus. Blurring of the edges of Kronig's bands may be present with or without actual narrowing. In these cases there is not a definite passage from resonance to dullness. This is sometimes the earliest sign that can be made out in early tuberculosis.

When both isthmuses are contracted, it is a sign, according to Riviere of hilus tuberculosis. Tidal percussion of both inner and outer boundaries is practised by some. The boundaries are marked out on quiet breathing and then the patient is asked to take a deep breath and hold it, whilst the examiner percusses rapidly from just inside the pencil marked boundaries to beyond them, and it is noted whether there is any expansion of the area or not. Riviere states that the amount of this expansion varies from nothing at all to a couple of centimetres or so, according to the manner of breathing at the inner boundary, but that the excursion is so small that in his opinion little help can be derived from apical tidal percussion.

Having now done the lateral and anterior aspects of the chest one proceeds to percuss the back from below upwards. It is advisable, first of all, to find the lowest limit of resonance in the line of the inferior angle of the scapula. On the right side in health during quiet breathing it should be at the level of the tenth rib, and on the left side it is usually lower in the tenth space. This is done with as light a stroke as

/possible,

possible, but the strength of the stroke depends on the muscularity and especially the obesity of the individual. In fact, in very stout people it is a very difficult and uncertain thing to do with exactitude. In examining the infra-scapular areas I generally sit with the patient standing somewhat obliquely with the left side towards me. The note in this area is resonant, and of low pitch unless muffled by muscle, fat or oedema. It is of slightly higher pitch on the right side near the lower margin of the lung, owing to presence of the liver, and on the left side there is sometimes a slight tympanitic note due to the stomach or colon.

TIDAL PERCUSSION: - Next tidal percussion is used to define the amount of expansion of the lateral and posterior bases on each side. In order to interpret one's findings accurately, the relation of the lower borders to the chest wall in health and during quiet breathing, as well as the surface markings of the costophrenic reflection of the pleura, must be remembered.

"During quiet breathing the lower border is found to be in the mammary line at the sixth rib in the mid-axillary line at the eighth rib, and nearer the vertebral column as low as the tenth space." (Hutchinson and Rainy). The level is slightly higher on the right than on the left side. The costo-diaphragmatic reflection of the pleura takes place at the level of the seventh costal cartilage, crosses the eighth chondro-sternal junction, and reaches the tenth rib, or possibly the tenth space in the mid-axillary line. From this point it proceeds backwards and slightly upwards across the eleventh and twelfth ribs and reaches the vertical column on the left side immediately below the head of the rib, and on the right side at a slightly higher level.

It is convenient in using tidal percussion to select the

/anterior

anterior axillary line and posteriorly a line drawn vertically downwards from the inferior angle of the scapula. What is the level of the base of the lung and of the pleural reflection in these two lines? In the anterior axillary line the base of the lung is at the level of the seventh rib or seventh space and the pleural reflection at the ninth rib or ninth space. In the scapular line it is at the level of the tenth rib or space, and the pleural reflection at the eleventh rib or space. There is room, therefore, for considerable movement of the lung border in these areas during deep inspiration, the possible amount varying in health according to age, stature, shape of the chest, and depth of the breathing. According to Riviere the limits are from three and a half to six and a half centimetres.

The disease conditions which limit the expansion are :-

- (1) Emphysema, in which the lung borders already being at a lower level than usual, there is less room for a further movement downwards during deep inspiration.
- (2) Loss of elasticity of the lower lobe from consolidation, infiltration or fibrosis.
- (3) Collapse of the lower lobe from obstruction of the bronchus which conducts the air to it.
- (4) Anything preventing the free passage of air into the alveoli, such as oedema, or bronchitis in the smaller tubes.
- (5) Adhesions between the parietal and visceral pleurae in the lower part of the lower lobes.
- (6) Adhesions between the costal and phrenic pleurae.

The most frequent causes in Pulmonary Tuberculosis of complete absence of expansion are pleural effusion at the base or a complete symphysis of the visceral and parietal layers due to the organisation of the effusion. In some cases these pleurises occur at a fairly early stage of the disease, and are generally found on the same side as the apex which is most affected, but

/sometimes

sometimes on the opposite side. In the cases where there is an effusion of any size, the base of the lung on that side will in addition be found to be at a higher level than usual.

In cases of considerable contraction of the lung from fibrosis, or fibrosis and cavitation, the diaphragm may be pulled up and a movement on inspiration diminished.. In cases of tuberculosis disseminated throughout a lung, the expansion is diminished and the tidal expansion therefore limited.

In fibroid tuberculosis with emphysema there is limitation of movement at the base according to the degree of emphysema.

Certain authors refer to limitation of the movement of one diaphragm as an early sign of Pulmonary Tuberculosis. When seen on the fluorescent screen it is known as Williams diaphragmatic sign. Corresponding to this sign there is diminished tidal expansion on physical examination. It is a sign, however, which is seldom present in early cases, and when it occurs it is difficult to account for, unless by assuming the presence of adhesions. Diminished elasticity of the lung, and reflex partial paralysis of the diaphragm are the theories put forward to account for it. But against the former is the well-known fact that many cases which are by no means early, show quite good normal tidal expansion. It is a sign which I have noted only in one case, in which there was impairment at the corresponding apex and a contraction of Kronig's isthmus with rather weakened breath sounds over the whole of that side. Kronig has referred to it as important in the differential diagnosis between tubercular and non-tubercular apical fibrosis. In my case the diagnosis of Pulmonary Tuberculosis was ultimately proved by finding tubercle bacilli in the sputum. The cases in

/which

which the absence or limitation of movement is confined to one aspect, back or front, are due either to adhesions between the visceral and parietal layers, or between the diaphragmatic and costal pleurae, or to disease confined to either the anterior or posterior lower border of the lung.

Tidal percussion is of value therefore: -

- (1) When the expansion though equal is notably diminished.
- (2) Where the expansion on one side is nil or decidedly less than the opposite side.
- (3) When there is a decided difference on the same side on the anterior and posterior aspects.

In percussing up the back it should be remembered that the note rises gradually in pitch from base to apex. (Riviere). The note is higher in the interscapular than it is in the infrascapular and higher still in the suprascapular area. This rise in pitch is, however, very gradual, except where there are diseased changes superadded. Over the scapulae the note is high-pitched, less resonant and less intense than in any other area, and little is to be gained by percussing over them. It is better to try to get them out of the way as much as possible by raising the patient's elbows.

RIVIERE'S REFLEX BANDS OF DULLNESS:- Riviere has described bands of dullness on the back of the chest. According to him they are found at the apex and across the lower scapular regions on both sides. "The upper of these bands reaches down to the level of the first and second dorsal vertebrae, the lower extends between the fifth and seventh dorsal spines". His contention is that they are present in all cases of active Pulmonary Tuberculosis, as well as in other diseased conditions, where there is an
/inflammation

inflammation of the lung parenchyma such as pneumonia or bronchopneumonia. They are absent in health, but can be produced by forcible percussion of the chest wall. He therefore advocates the examination of the back by light percussion first, before doing anything else. They are found on both sides of the chest but most markedly on the side of the most advanced disease.

Riviere appears to be the only writer who describes these bands. I have not been able to satisfy myself of their presence.

It is of greater importance to be on the outlook for areas of paravertebral dullness in the interscapular regions. When this is well marked it is due to consolidation in the upper part of the lower lobe. When slight, it is generally found on the right side, and thought by Riviere to be due to enlargement of the tracheo-bronchial glands, pressing on the right branch of the pulmonary artery which is directly in front of them. This is said to lead to incomplete expansion of the right lung, with the result that there is a slight impairment over the whole side, but especially in the paravertebral area. Fishberg also states that he has seen a few cases in which enlarged thoracic glands produce dullness all over one side of the chest but on the whole he does not rely very much on percussion in the diagnosis of the enlargement of intrathoracic glands. John Guy states that there may be a widespread glandular involvement without any evidence being obtained by percussion. To be of any value this sign must be constant as it is very easy to imagine slight dullness, and in any case transient areas of dullness are quite possible, due to a bronchus being temporarily plugged with mucus producing atelectasis in the air vesicles it supplies. I have in the last three or four years been specially watching for this sign in cases of school children either suffering or supposed to be

/suffering

suffering from tuberculosis, and have only in a very few cases been able to satisfy myself definitely of its presence.

Percussion of the dorsal spines is also practised with a view to eliciting dullness over one or more of them, but I have not found it of any value.

The area which repays one most for careful attention paid to it is the supraspinous area, and more obvious dullness is often found here in a lesion at the apex of the upper lobe than in the corresponding area in the front of the chest. Sometimes the first percussion sign to be found is dullness at the extreme apex. Whilst in a healthy lung the resonant note extends as high as the interval between the seventh cervical and first dorsal vertebra, in an infiltrated apex it is decided lower, owing to retraction of that apex. It will be found also in these cases that Kronig's inner band is dislocated outwards. Kingston Fowler has shown from his pathological studies that the primary lesion is situated nearer the posterior and external borders, about an inch and a half from the summit. He says, "Lesions in this situation tend to spread in the first instance backwards", and further on, "It is not unusual to find, in these scattered nodules, the only evidence of disease on the anterior aspect of the lung, when posteriorly excavation has advanced to such a degree, that but little more than the pleura remains." This is no doubt the morbid anatomy of the type of case with advanced lesions behind ^{but} ~~the~~ very little definitely abnormal in front.

The apex of the lower lobe about the level of the fourth or fifth dorsal spine half way between the vertebral column, and the mesial border of the scapula also requires special attention, as the lesion in this locality may be present at an early stage

of the chronic and fibroid types of Pulmonary Tuberculosis.

(Kingaton Fowler). I have rarely, however, been able to detect dullness here, except when the dullness is continuous from the apex to this level. I have seen it, however, in a few cases.

It is now necessary in detail to study:-

- (1) The changes in the chest wall which produce a variation in the note, and
- (2) The changes in the pleurae and lungs.

CHANGES IN THE CHEST WALL:- These changes in some cases are due to disease, old or present, of the organs in the chest, but in any case a modification of the note results from them.

AGE:- The child's chest is more elastic than that of the adult, and resonance is more readily elicited.

Ossification of the costal cartilages in the aged produces a more rigid chest wall, which vibrates less freely when percussed. The note is less resonant and of a higher pitch. Scoliosis with projection of the ribs on the side of the convexity alters the percussion note, which is of higher pitch over the projecting part. Muscularity modifies the note; the thicker the muscle the less the resonance.

The state of the muscles on the two sides is of great importance. In certain individuals there is congenital absence of the pectoral or clavicular part of the sterno-mastoid. On contrast percussion a more resonant note is found on the side of the absent muscle. Similarly atrophy of muscle will tend to produce a greater degree of resonance on that side provided that the condition of the lung underneath does not neutralise this effect. This, however, often happens when the wasting is due to chronic tuberculosis of the lung. Hypertrophied muscle on one side of the chest due to occupation renders the note less

/resonant.

resonant.

Any local thickening of the chest wall, whether from tumour, a collection of fluid, as in oedema or abscess, produces a dull note, whereas a collection of air in the subcutaneous tissues, as in surgical emphysema, gives a tympanic^{it} one.

Pottenger drew attention to the increased tone of muscle as a factor in impaired resonance over an active lesion of tuberculosis. He ascribes this to a reflex. Just as an inflammation of the peritoneum reflects itself on the surface of the abdomen by an increased contraction of muscles there, so over the lung there is a hypertonus of the muscles which derive their nerve supply from the same spinal segment as the afferent nerves from the lung finally terminate in. This hypertonus is due to impulses proceeding from the area of disease in the lung up along the afferent nerves to the spinal cord where they pass on to the motor nerve cells in the anterior horn of that area, and thence down the efferent nerves to the muscles. Where on the other hand there is wasting of muscle the lesion is of old standing. Theoretically this wasting should make the note less dull, but in actual practice one generally finds relative dullness on the side of the wasting, because the increased solidification of the lung due to the old disease, or to a recrudescence of disease in the old focus, more than neutralises the effect of the wasting. In this way my experience coincides with that of Fishberg. Enlarged glands in the supraclavicular area also give rise to a dull or less resonant note.

Having considered the conditions in the chest wall altering the percussion note, let us now consider the changes in the pleurae and lungs which do so also, and the nature of the

/alteration

alteration produced.

PLEURAL AFFECTIONS:- In ordinary dry pleurisy the note is not altered over the area affected and percussion does not therefore play a part in its diagnosis. If, however, it causes considerable pain, the patient will involuntarily limit the movement on the affected side, and tidal percussion will show limited movement at the base of the affected side.

The pleurisies which occur in the course of Pulmonary Tuberculosis as a rule terminate either in adhesions with or without thickened pleura, or in effusions. Adhesions affect the tidal expansion as already indicated. Where, in addition, the pleura has become thickened the note in percussion is impaired according to the degree of thickening. Sometimes the thickening at the base is so great that the percussion note is devoid of all resonance, as none of the vibrations set up in the chest wall are transmitted through the thickened pleura. The very thick pleura, in fact, acts in the same way as a layer of fluid, and at first fluid may be suspected. If the level of the dullness is worked out, however, it will not be found to correspond to that of an effusion; generally the dullness extends higher up posteriorly than laterally or anteriorly; though occasionally it is higher in front than behind. The affected side of the chest also appears smaller and flatter than the opposite side, and the heart is in many cases pulled over to the same side, whereas with an effusion even of moderate size it may be pushed over to the opposite side.

In a pleural effusion ~~of the general pleural cavity~~ unless there are adhesions present, the level of the fluid forms a curved line, the highest part of which is in the midaxillary or

/scapular

scapular region, declining as it proceeds both forwards and backwards. In smaller effusions, the level is practically horizontal. When with a large effusion up above the inferior angle of the scapula, there is an absolutely horizontal line when the patient is in the erect posture, one should suspect the presence of a hydropneumothorax. This can readily be confirmed by altering the position of the patient. It will be found that the level of the fluid still remains horizontal, with the result that over the lower part of the chest anteriorly, which, in the erect posture was quite dull, with the patient lying on his back there is now a tympanitic note. The upper level of the fluid in an effusion does not alter in this obvious manner with the alteration in the position of the patient, but remains practically the same.

When the effusion is on the left hand side, there is generally a dull note over Traube's space, where normally the note is tympanitic owing to vibrations being set up in the stomach. The boundaries of this space are, above, the lower border of the left lung, below, the costal margin, on the left, the anterior border of the spleen, and above and to the right, the lower margin of the left portion of the liver.

GAIRDNER'S LINE:- This is the line joining the anterior axillary fold on the left to the umbilicus. In the normal this is resonant throughout. In most cases of pleural effusion there will be dullness over this line from the upper level of the fluid to the costal margin. It crosses Traube's space and the note over it is altered in a similar way by a pleural effusion.

One of the most important percussion signs in pleurisy with effusion is the increase in cardiac dullness on the side

/opposite

opposite the effusion. This is due to the heart shifting its position away from the effusion. This alteration takes place quite early and is due to the difference in amount of negative pressure on the two sides. The causation is quite different to that of the downward displacement of the diaphragm in large effusions. This occurs only after the accumulation of a large amount of fluid, which converts the normal negative to a positive pressure, which is greater than the upward atmospheric pressure transmitted to its under surface through the abdominal wall.

This sign, therefore, only occurs late in the effusion, whilst the displacement of the heart may take place with a quite small effusion. When it does occur it can be detected by percussion of the abdomen, when the liver dullness will be found, if the effusion is on the right hand side, to be lower than normal, and if on the left, the stomach and spleen may be found lower than the normal.

The displacement of the mediastinum can sometimes be made out posteriorly as a dull area triangular in shape. The base of the triangle lies along the vertebral spines from the upper level of the fluid to the base of the lung. A line is then drawn at right angles to the lower extremity of this line, for a few inches on the side opposite the effusion, and a line joining these two forms the third side of the triangle. This is called Grocco's triangle. On the same side as the effusion, the lung above ^{the} its upper limit of the effusion, gives, on percussion, not normal, but tympanitic resonance. This is due to the relaxed state of the lung which enables the air in it now to vibrate as if it were in one large chamber instead of divided up into numerous chambers by fibro-elastic septa. The tympanicity is, however,

of high pitch owing to vibrations of the chest wall being limited by the presence of the effusion (Halliday Sutherland).

The next alteration to be considered in the pleura altering the note on percussion is pneumothorax or air in the thorax. This condition when spontaneous is due to rupture of the lung which allows the escape of air into the pleural cavity, or puncture of the thoracic wall, allowing in the entrance of atmospheric air.

The air being free in the pleural cavity, it vibrates in the same way as gas in the stomach or colon, and a tympanitic note is the result. This may be high or low pitch according to the tension of the air. If more air is entering through the tear in the lung into the pleural cavity during inspiration, than is passing back^{out} during expiration, the tension gradually increases and the note rises in pitch. In cases of this nature which recover, the pressure goes on increasing until it is great enough to prevent the entrance of any more air, when the aperture tends to close, and healing takes place. (Fishberg). After that the air is gradually absorbed, the tension diminishes and the note becomes lower in pitch. There is also the other type of case in which air passes in and out again during inspiration and expiration. In this case there is no great tension of the air, and the pitch of the note is low. Very often a pneumothorax is complicated by infection of the pleural cavity, for along with the air, either tubercular or septic material escapes into the pleura through the ruptured lung, and a hydro or pyo-pneumothorax is set up. In these cases there is absolute dullness at the base. The upper limit of the dullness is hori-

/zontal



zontal and remains horizontal when the position of the patient is altered, so that whilst in the erect posture there is dullness anteriorly, laterally, and posteriorly, when the patient is lying on his back, the note in front is quite resonant or tympanitic, and the anterior part of the lateral zone is also free from dullness. In pneumothorax also, as in an effusion the heart and mediastinum are drawn over to the opposite side, and the cardiac dullness found to be increased to the right or left according to the side of the ruptured lung.

There is another sign often obtained in pneumothorax. This sign is made out by a combination of auscultation and percussion. An assistant percusses a coin which is laid on the chest wall with another coin, and the examiner listens at the back. Another method suggested by Fishberg is to percuss with a thimble worn on the percussing finger, whilst the finger-nail of the pleximeter finger is struck. I am not familiar with this method, but with the former a clear bell-like sound is obtained, or sometimes it is more like the clanging of a hammer on an anvil, when the sign is positive.

Localised pneumothoraxes which are shown up in the skiagram sometimes do not give any signs.

PERCUSSION SIGNS OVER A CAVITY IN THE LUNG:- These depend on several different factors:-

- (1) The size of the cavity.
- (2) Its position, relative to the surface of the lung.
- (3) Whether it freely communicates with a bronchus or not.
- (4) On the state of its walls, and
- (5) If it is superficial whether the visceral pleura is thickened and adherent to the parietal layer.

Where it is large, superficial, thin-walled and in communication with a bronchus, it gives a tympanitic note over that portion which is empty and a dull note over the portion filled

/with

with secretion.

Cavities which are deep seated, or cavities in the midst of consolidated lung, cannot be diagnosed by percussion. Large cavities which are superficial but have strong unyielding walls or where the pleura is greatly thickened or adherent may be completely dull, or give the wooden boxy note. Consolidated areas of lung surrounded by areas of compensatory emphysema give a similar note. Large superficial cavities with thin walls and communicating with a bronchus, besides being tympanitic, will show Wintrich's phenomenon. *The low pitch of the tympanitic note becomes higher when the mouth is opened, as this reduces the available vibrating area of confined air*. (Halliday Sutherland)

Again if percussion is done during a deep held inspiration and again after a full expiration the pitch changes from high to low. Friedrich's phenomenon.

Gerhardt's sign is found in a large superficial cavity with the long diameter vertical containing air and fluid. In the upright position the pitch is higher. When the patient is recumbent the pitch is lower owing to increase of the vibrating area. Again a cavity may be tympanitic immediately after it has been emptied and at a later examination after it has had time to refill become quite dull.

CRACKED POT SOUNDS:- This again can only be perceived over that type of cavity which gives a tympanitic note. It is elicited by percussing forcibly over the cavity when the patient has his mouth open. When present a chinking sound is heard, due to the sudden forcible expulsion of air from the cavity through the communicating bronchus.

/ AUSCULTATION:

AUSCULTATION.

The instrument employed is an ordinary binaural stethoscope. The important things about a stethoscope are that the ear pieces should fit the examiners external meatus accurately, that they should not press inwards too strongly, and that the chest piece should be capable of being applied accurately to any part of the chest it is desired to auscultate, and to any kind of chest. It is, therefore, desirable to have a chest piece with two ends of different sizes either of which at will may be applied to the chest wall. This is necessary because many of the chests one has to examine have very little subcutaneous tissue, and the muscles are wasted, so that especially on the lateral aspects of the thorax it is impossible for the rim of the ordinary standard chest piece to be in contact all the way round with the skin of the patient, and the breath sounds cannot be heard. In these conditions the smaller end which should also be somewhat elliptical in shape is used.

BREATH SOUNDS:- The main types of breath sounds heard in auscultating over the lungs are the vesicular and bronchial, and a third which has some of the characters of each of the two main types, the bronchovesicular. The bronchial breath sounds are heard normally over the seventh cervical spine; bronchovesicular over the manubrium and upper part of the interscapular region behind. In all other parts of a normal chest the type is vesicular except perhaps over the right apex to the second rib and to the spine of the scapula behind, where in some normal chests it may be bronchovesicular or even bronchial.

The Vesicular Type:- This consists of a soft rustling sound during inspiration. During expiration which follows

/immediately

immediately without any appreciable interval there is a sound of lower pitch, shorter duration and of a faintly blowing character.

Bronchial Type:- In this the inspiratory sound is higher in pitch, resembling that over the trachea, whilst the expiration is higher in pitch, usually more intense, and either of equal or longer duration, and separated from inspiration by a distinct interval.

Broncho-vesicular Type:- This combines the character of the two main types. Inspiration is higher pitched than in the vesicular type, and approximates more or less to the bronchial type. The expiration is also higher pitched and prolonged in duration.

During auscultation the observer has to attend :-

- (1) to the breath sounds in the inspiratory and expiratory phase, noting whether they are normal or not, and if not in what respect they are abnormal, and
- (2) to any adventitious sounds that may be present.

This is done in all the different areas of the chest, and each area compared with the corresponding area on the opposite side. This is necessary because it is not possible to fix an arbitrary standard of normal vesicular breathing for all chests. There is great variety in this respect in different chests. Where the muscles over the thorax are well-developed the breath sounds are not so intense, as the sound produced in the lungs has a thicker wall to penetrate. Some patients are poor breathers and do not expand their chests properly, and here again the breath sounds are weak. In some it is possible by showing them how they are required to breathe to overcome this, but not in all. These poor breathers are generally sedentary workers who do not take sufficient exercise, with the result that the muscles of respiration are poorly developed. Again in abdominal breathers the breath sounds are weak in the upper portions of
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the chest. Nasal obstruction may cause weak breathing but when the patient is asked to breathe through the mouth, normal vesicular breath sounds are heard.

CHARACTER OF THE BREATH SOUNDS IN PULMONARY TUBERCULOSIS:-

This varies according to the pathological changes brought about by the tubercular process. It is always essential to translate the sounds heard on auscultation into terms of morbid anatomy. When complete consolidation has taken place bronchial breathing is heard. When the consolidation is more or less incomplete the breath sounds are broncho-vesicular. If the diseased lung breaks down and a cavity is produced cavernous or amphoric breath sounds will be heard if the conditions are favourable. Where the tubercles are not sufficiently close together to produce bronchial or broncho-vesicular breath sounds, prolonged expiration may be the only change. Where they are in sufficient number to obliterate some of the air cells, weak breathing is produced. Where they have not obliterated a sufficient number of air cells to produce weak breathing, they may so interfere with the air current that the breath sounds are harsh and interrupted, and when they are fewer still, slight roughening of the breath sounds may be all that can be detected. Roughening of the breath sounds may, however, be heard over large areas of the lung which present no other abnormality, and in these cases they do not indicate tuberculosis. It is only when this sign is limited to a circumscribed area that it has any value. It is an indication that there is some interference with the smooth inflow of air into the alveoli and this may be produced by changes other than those due to tuberculosis. If, however, it is found in a circumscribed area, early tuberculosis

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is a probable cause. That the harsh wavy breath sounds are heard in an earlier stage than feeble breathing may be inferred from the fact that in cases with weak breathing at the extreme apex, the harsh interrupted type is often found lower down in the second and possibly third interspace (Kingston Fowler).

It is here necessary to digress a little and consider the normal differences in the breath sounds at the two apices. This is a great source of difficulty with beginners, as they are liable to diagnose an area of Pulmonary Tuberculosis at the right apex where there is none present, because the character of the breath sounds there, are found to be broncho-vesicular or sometimes even bronchial. There is considerable variety in the normal at the right apex. The most common type is the rather higher pitched and more intense inspiration with prolonged expiration. In others the inspiration and expiration approach nearer the bronchial or tracheal type. It is never safe to diagnose a lesion at this apex from the character of the breath sounds alone, and some dullness should definitely be made out as well. If it is remembered that the right apex is in close contact with the trachea, only a thin layer of connective tissue intervening, whilst on the left side it is separated from it by blood vessels and a comparatively thick layer of connective tissue, it can readily be understood why the tracheal sounds are more easily transmitted to the right than to the left side.

It is from the summit of the lung to the second rib and to the spine of the scapula behind that these differences are normally present, but in all other areas of the chest the breath sounds where the lungs and pleurae are normal, and the thoracic walls symmetrical, should be practically identical on the two

/sides.

sides.

Some of the alterations in the breath sounds mentioned above may be present in cases of Pulmonary Tuberculosis and not be due to actual disease of the lung in the area in which they are heard, but to the pleura being involved. Weak, sometimes completely absent, breath sounds are found where there is an effusion in the pleural cavity. In other cases the breath sounds approach the bronchial, or are completely bronchial. In the one case the effusion is sufficient to compress the bronchial tubes through which air is unable to enter into the portion of lung compressed and in the other the small bronchi, bronchioles and alveoli are compressed, but the larger bronchi to the part remain patent. Again the breath sounds may be weak over areas of the lung where the visceral and parietal layers of pleura are adherent and prevent full expansion of the lung. Harsh exaggerated breath sounds are heard over areas which have had to take on an increased function due to disease in other parts. If one lung is thrown out of action by gross disease or by fluid in the pleural cavity causing collapse on the other side, the breath sounds are harsh and more intense. Similarly, parts adjacent to diseased areas in the same lung take on an increased function and present this type of breath sound. Where there is much fibrosis the breath sounds are weak in the fibrosed areas and often harsh in adjacent areas.

Cavernous breath sounds are a low pitched type of bronchial breathing. The inspiration is lower pitched than in ordinary bronchial breathing and more hollow, and the expiration is lower pitched than the inspiration and of longer duration, whilst there is a distinct pause between the two phases. Amphoric breathing is a more marked form of cavernous breathing with a hollower tone. They both indicate pulmonary cavity, or air in /the

the pleural cavity.

ADVENTITIOUS SOUNDS: - These are generally called râles, and are subdivided into dry and moist râles. Dry râles are called rhonchi and are due to inflammatory swelling of the mucous membrane of the bronchial tubes, or to the presence therein of tough mucus. According to the calibre of the tube in which the sound is produced, the rhonchi are called sibilant or sonorous. The former are produced in the small and the latter in the large bronchial tubes.

Moist râles and crepitations are used by most writers as synonymous terms. They are due to air bubbling through fluid in the tubes, or to the separation of the walls of the fine tubes and alveoli when they are stuck together by moisture. The sound produced when this occurs is called fine crepitations and has been likened to the sound produced by rubbing hair between the finger and thumb near the ear. This sound may be heard over a considerable part of a lung in the early stages of pneumonia, over the margins of the lungs in emphysema, and at the base in congestion or oedema. When heard at the apex it usually means Pulmonary Tuberculosis. Medium and coarse crepitations are due to fluid in the medium and large bronchial tubes. All these sounds are often toneless, but when produced in the vicinity of consolidated lung or a cavity, they become sharper in character and clearly defined, and are said to have a resonant or consonating character. Sometimes they become specially clear and tinkling, when the râle is called metallic tinkle. This râle is pathognomonic of pulmonary or pleural cavity (pneumothorax). Gurgling râles are large liquid râles produced by bubbling through the secretion in a cavity. Clicking râles resemble

/the

the sound produced by whispering the word "Click". They occur often singly and are heard only during inspiration.

Auscultation is even more difficult than percussion. This is because there are more points to be attended to in auscultation than in percussion. In the latter there is only the one thing to listen to, viz: the percussion note. In the former one has to listen to both the inspiratory and expiratory phase of the respiratory murmur and to the character of the adventitious sounds when these are present. All these things have to be attended to separately and compared with the same things in the same area on the opposite side. Now for comparative purposes most people find it is easier to take one thing at a time, so that what is called single phase auscultation has been advocated by some writers. (Fishberg.) In this method the inspiratory phase is attended to on one side and then compared with the same phase on the opposite side, the stethoscope being transferred from the one side to the other during expiration. Then the expiratory phase is taken and the stethoscope moved to the opposite side during inspiration. When this has been done adventitious sounds are listened for, again the two sides being compared. In many cases this method which is time consuming is not at all necessary for purposes of diagnosis. As a routine, I find it better to listen to both phases in each area and note the presence or absence of adventitious sounds. When an abnormality is detected I then employ the single phase method and concentrate on the abnormality present, with a view to a fuller appreciation of its significance.

Friction Sounds :- These differ from ^{rales} in that one has the sense of two surfaces rubbing against each other, and they are audible usually both during inspiration and expiration.

The sounds appear to come from just beneath the surface. They are not altered by cough, and are generally associated with pain localised to the area where the sound is heard, or the pain may be referred to some adjacent part of the chest. Sometimes there is a definite friction rub without pain, but in these cases there is generally a history of pain. In others there is very definite pain of the same stabbing character as is found when a rub can be heard, but instead of a characteristic rub, there is a sound more like crepitation. In these cases according to Kingston Fowler, the sound heard is probably due to a patch of exudate on the underlying pleura or fine fibrous adhesions. During the course of Pulmonary Tuberculosis this is often the only adventitious sound heard in areas where the patient complains of a sharp stabbing pain.

VOCAL RESONANCE: - This is the sound transmitted to the ear of the examiner when the chest piece of the stethoscope is over the lung area, and the patient speaks. For this purpose he is usually asked to say ninety-nine. It varies in intensity in different parts of the chest and is loudest in the proximity of the trachea and large bronchi. This is particularly noticeable in thin persons, especially children. It is normally louder over the right apex to the second rib in front and to the spine of the scapula behind.

Bronchophony: - This is a particular type of increased vocal resonance. It is louder, higher-pitched, and the voice appears to come from just below the end of the stethoscope. Bronchophony is normally present over the lower cervical spines and in some chests over the sternal portion of the infraclavicular areas, and in the upper part of the interscapular areas. It is not, however, present in by any means every chest in these areas. Pectoriloquy differs from broncho-phony in that the actual words

are heard clearly and become articulate. The voice may be either whispered or spoken. Both of these conditions denote consolidation, but pectoriloquy sometimes denotes a cavity. Kingston Fowler states that if pectoriloquy is accompanied by the characters of bronchophony, (nearness to the ear and elevation of pitch) the transmission is by solidified lung; if, on the other hand, speech is transmitted, and the characters of bronchophony are wanting, the inference is that the pectoriloquy denotes a cavity.

Aegophony: - This is a modified form of vocal resonance where the sound has a nasal or bleating character. It is often heard in cases of pleurisy with effusion, but in my experience is just as often absent. It is heard generally in the neighbourhood of the angle of the scapula.

POINTS ABOUT AUSCULTATION IN DIAGNOSIS: - It must always be remembered that the normal vesicular breath sound is not exactly the same in all normal chests. It varies considerably according to age. In children it is more intense and harsher, in thin people it is often louder and more easily heard, whilst in stout people the thickness of the subcutaneous tissues prevent the full sound from being transmitted to the ear, and the murmur is weak. This is so also to some extent in muscular individuals, but more often in them a rumbling sound is heard and the vesicular sound suppressed. Then again previous diseases owing to certain pathological changes brought about, may have caused a permanent alteration in the breath-sounds. A history of previous attacks of pneumonia or pleurisy may help to explain changes found in the breath sounds in certain areas. Changes in the breath sounds and râles due to bronchitis and emphysema are not infrequent, as Pulmonary Tuberculosis often becomes superadded. In some of these cases all the auscultatory signs are those of the former /diseases ,

diseases, and even percussion may not be of much help so that the diagnosis depends finally on the X-ray and sputum findings. In others again though the chief signs are those of emphysema and bronchitis, there are definite auscultatory and percussion signs at one apex, dullness, bronchial breath sounds and crepitations. The X-ray, however, may show a much wider implication than was expected from the physical signs alone.

There are many cases with well marked râles, which are apt to be mistaken for tuberculosis if the auscultatory signs alone are attended to. When these occur at the bases of the lung there is generally a history of broncho-pneumonia or bronchitis, and they are probably due to dilatation of the smaller bronchi (bronchio-lectasis) in these areas. They are not uncommon in children, and may be present on one or both sides. Sometimes the râles extend upwards to near the apex on one side, and then they are almost certain to be mistaken for tuberculosis by practitioners who have not an opportunity for seeing large numbers of chest cases. The fact that the patients are moderately well, that they have had a long history of chest trouble, that the signs on percussion are practically nil, at all events much less than would be expected in cases of tuberculosis with so many adventitious sounds, that the X-ray photograph shows practically no mottling and only some increase in the hilus shadows and peribronchial thickening, and that the sputum, when present, is on frequent and numerous examinations negative as regards tubercle bacilli, all point to some other condition than tuberculosis.

/SPUTUM EXAMINATION:

SPUTUM EXAMINATION:

When tubercle bacilli are found in the sputum this settles the diagnosis. This is the most certain sign of all, but even here there are certain fallacies to be guarded against. It is quite possible that one or two bacilli may be found in the sputum of an individual in contact with patients who are expectorating bacilli, and although he himself has no lesion of Pulmonary Tuberculosis, so that it is hardly safe to accept the presence of one or two acid fast bacilli as definite proof. If, however, they are found on more than one occasion, or if several are found in one film, and the patient shows any signs or symptoms, the presumption that he has a lesion amounts to practical certainty. Where there are any suggestive symptoms or signs it is imperative that frequent examinations of the sputum should be made. It is also imperative that a considerable amount of time should be spent over each film. It is not enough to spend a minute or two, but from ten to fifteen minutes should be taken over each before it is pronounced negative. It is my practice to examine the sputum every second day after admission until about twelve negative examinations have been made, and at greater intervals subsequently. If it remains persistently negative it does not follow that the patient has not Pulmonary Tuberculosis. But if the patient is expectorating yellow purulent or muco-purulent sputum, and the physical signs and X-ray are not definite, it is wise to seek for some other explanation of the symptoms and signs. Some of these cases are chronic bronchitis and emphysema, some bronchi-ectasis, and some abscess of the lung. In the two latter the physical signs are as a rule at the base. A leucocyte

/count

count is sometimes helpful in acute abscess.

There are, however, many real cases of Pulmonary Tuberculosis who either have no sputum, or have no tubercle bacilli in their sputum. In some of them the disease has become quiescent, and although the physical signs and the X-ray clearly demonstrate pathological changes, the bacilli are no longer being discharged..

If these cases have been under observation for a number of years there will be a history of positive sputum, at some time or other, having been found. In the fibroid type of the disease bacilli may be very scanty, and only found once over a long series of examinations. I have one patient in whom over twenty to thirty examinations were made over a period of twelve months, and the bacilli were found only once.

Then there are the early cases in whom the tubercles have not yet broken down, but in whom if the disease is progressive bacilli will ultimately be found. A number of patients are admitted to the Sanatorium in this stage and not till after several examinations are bacilli found.

When the signs are unequivocal, bacilli are generally found fairly soon provided there is sputum, and in nearly all sputum positive cases whom I have X-rayed there has been an area of definite mottling of some part of the lung.

A large number of cases have been admitted with suspicious symptoms and only very slight signs, in whom the sputum during repeated examinations has been found negative. These patients are run down in health, have lost weight, are easily tired, have a slight cough and some of them a little sputum. What are we to say of these cases? The signs are slight alteration in the percussion note at an apex and slight alteration in the breath

/sounds.

sounds. Many healthy people who state that they feel perfectly well, and have never suffered from any chest trouble, present similar changes from the normal standard. It is very difficult in these cases to make a diagnosis with any degree of certainty. Of course it is easy enough to call all such cases Pulmonary Tuberculosis, and get credit for the number of early cases discovered. The truth, however, appears to be that some of them are, and some of them are not tuberculosis. The only sensible thing is to observe these cases, examine them at frequent intervals, and note whether either the symptoms or signs are progressive, and of course when there is sputum have it examined at frequent intervals. In some of these cases the X-ray is of value in deciding. In some it shows slight mottling or haziness at the apices above the clavicles. One is, however, often surprised with the X-ray findings. In some cases where the signs at an apex appear quite definite the plate shows no abnormal opacities and in others with less evidence on physical signs, the plate ^{is} ~~seems~~ quite definite. I am not able at present to account for these apparently inconsistent findings, but am inclined to accept positive evidence from either source, where the symptoms suggest tuberculosis.

Where the symptoms point definitely to the respiratory tract being affected, but there is very little or no constitutional disturbance and where the signs can be explained as due to some affection other than tubercle, unless the X-ray or sputum is positive, tuberculosis should be ruled out. Some of them are due to nasopharyngeal catarrh, some to bronchial catarrh, bronchitis and emphysema, others to collapse and induration at an apex secondary to nasal catarrh. Some are due to inhalation of vegetable or mineral matter as in anthracosis and silicosis.

In these latter it is very difficult to exclude tuberculosis, and it is not possible to be certain in many of them that tuberculosis has not been superadded, though the X-ray may be of some help when it shows larger opacities than are usually shown by anthracosis or silicosis per se. Constitutional symptoms must be the deciding factor when both the X-ray and the sputum are negative, as the physical signs give uncertain information.

Slight signs at one apex, slight dullness, or narrowing of Kronig's isthmus and slight alterations in the breath sounds may be present in people who feel perfectly healthy. But cases where they are found along with symptoms of local and constitutional disturbances, where cough sputum, and tired feelings, loss of weight and appetite are present, and particularly when there has been any haemoptysis, even though the X-ray and sputum are negative, should be treated as Pulmonary Tuberculosis, as some of these cases develop more definite physical signs, and positive X-ray and sputum later on. The suspicion becomes practically a certainty if crepitations also are present in these cases.

A table is appended of twenty eight negative sputum cases illustrating the necessity of considering carefully the information from history and symptoms, physical signs and X-ray examination before coming to a diagnosis.

Cases 1,7,10,19,21,25, were not accepted as cases of Pulmonary Tuberculosis, all the others were.

In most of the tuberculosis cases the physical signs and X-ray confirmed each other. In 11,12 and 13, the X-ray was, however, of especial value in definitely confirming what were only slight signs. Whilst in 14,18,20 and 27, the X-ray gave no information and the diagnosis had to be based on signs and symptoms alone.

NEGATIVE SPUTUM CASES.

<u>CASE.</u>	<u>HISTORY AND SYMPTOMS.</u>	<u>SIGNS.</u>	<u>X-RAY.</u>
(1) R.W. M. Age 20.	Bronchitis and Asthma. Evening . Temperature normal.	Slight dullness right apex back and front. Indrawing of inter costal spaces.	Slight increase of hilus shadow.
(2) L.W. M. Age 34.	Tubercular peritonitis ten years ago. Cough, sputum, shortness of breath. Pain on right side, Slight Haemoptysis, streaking. Evening Temperature normal.	Dullness left apex. Dullness right side posteriorly from spine of the scapula to base and weak breath sounds right base. Tidal percussion shows limited expansion at this base.	Lagging of the right diaphragm.
(3) E.T. M. Age 33.	Cough, bronchitis, shortness of breath, loss of weight, tiredness, slight sputum. Evening Temperature normal.	Asymmetrical chest. Slight dullness right apex above the clavicle. Breath sounds weak at right base. Signs of bronchitis and emphysema.	Very marked peribronchial fibrosis radiating outwards from right hilum. Similar condition on left side but to a lesser degree. Opaque nodules round both hila, but most on left side. Right apex shows some mottling. Screen examination shows right diaphragm tucked up by adhesions.

NEGATIVE SPUTUM CASES (Continued)

CASE.	HISTORY & SYMPTOMS.	SIGNS.	X-ray.
(4) A.B. M. Age 39.	History of having been in a Sanatorium eight years ago. Present symptoms eight weeks duration. Cough, sputum, tiredness, night sweats, pain across sternum, shortness of breath. Evening Temperature normal, except for 1 week when 99° to 100°.	Drooping of right shoulder, hollowing above both clavicles, chiefly the right, narrowing of Kronig's isthmus and dullness above right clavicle and to spine of scapula posteriorly. Breath sounds weak generally, especially right side.	Increased hilus shadow, especially right side with marked contraction of right apex and some peribronchial fibrosis.
(5) B.B. F. Age 31.	Cough, sputum, history of haemoptysis, shortness of breath, tired feelings, loss of weight. Evening temperature 99° to 100°.	Dullness left apex to second rib and slight dullness posteriorly. Harsh breath sounds in same locality and V.R. plus. Breath sounds in left interscapular area weak with some crepitation.	Definite but rather fine mottling as low as fourth anterior rib on the left side. Increased hilus shadow on the right side.
(6) W.B. M. Age 14.	History of pneumonia and bronchitis, cough, sputum, shortness of breath. No other symptoms. Evening temperature normal.	Breath sounds weak and harsh with fine râles at both bases. S.C.D. diminished. Some emphysema.	Hilus shadow both sides very dense, prolonged upwards and downwards, with very marked peribronchial fibrosis. Mottling both apices.

NEGATIVE SPUTUM CASES (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(7) F.B. M. Age 19.	History of pneumonia and bronchitis, loss of weight in last three years, shortness of breath on exertion, no cough or sputum. Evening temperature 99° to 100°. Enlarged thyroid. Tachycardia.	Slight droop of right shoulder hollowing above right clavicle dullness at right apex back and front, prolonged expiration. Otherwise breath sounds anteriorly are weak and roughened. Kronig's isthmus right 1 $\frac{1}{4}$ ", left 2 $\frac{1}{2}$ ".	A number of opaque nodules at both hila with peribronchial thickening radiating outwards, downwards and upwards. Right apex narrower than left.
(8) E.B. M. Age 17.	Slight cough and sputum, dyspnoea, family history. Evening temperature normal.	Slight dullness at right apex and at left apex.	Slight contraction of right apex.
(9) H.C. M. Age 44.	Cough, sputum, history of haemoptysis (streaking) two years ago. Dyspnoea, loss of weight, fatigue, history of night sweats, evening temperature normal.	Flattening right side of chest. Slight dullness right apex to second rib and to inferior angle of the scapula posteriorly, bronchial breath sounds, and V.R. plus inner end of second space. Breath sounds weak left base posteriorly.	Mottling both apices and on right side from the clavicle to the second rib especially in second interspace where the mottling is of a coarsely reticular character. Both hilus shadows increased, and numerous calcareous glands both sides.

NEGATIVE SPUTUM CASES. (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(10) J.C. M. Age 26.	Cough and sputum four years, marked shortness of breath, has had streaking of sputum four times. Night sweats, fatigue, loss of weight. Evening temperature occasionally slightly above normal 99° to 100°.	Scar of old empyema operation left base. Indrawing of lateral intercostal spaces on inspiration. Left side does not expand so well as right. Slight dullness to second rib and at left base posteriorly. Tidal percussion shows poor expansion at left base. Medium crepitation all over left side and some at right base.	Only slight accentuation of the normal markings, especially on the left side.
(11) J.C. M. Age 23.	Frequent colds, cough, slight dyspnoea for two months, loss of weight during last year. Slight staining of sputum on four occasions, evening temperature slightly raised 99.0 to 99.6°	Hollowing above and below left clavicle. Slight dullness above Kronig's isthmus right $2\frac{1}{4}$ " left 2". Slight dullness first right interspace. Lagging left apex posteriorly. Breath sounds higher pitched with prolonged expiration at left apex.	Increased hilus shadow both sides especially left. Left apex somewhat smaller than right. Abnormal rounded shadows rather smaller than a pea in the outer part of first right interspace and above the right clavicle. Some also in first left interspace.
(12) E.C. F. Age 13.	Family history, debility, loss of weight, evening temperature normal.	Slight dullness first left interspace.	Mottling in first left interspace.

NEGATIVE SPUTUM CASES (Continued)

<u>CASE.</u>	<u>HISTORY AND SYMPTOMS.</u>	<u>SIGNS.</u>	<u>X-RAY.</u>
(13) W.D. M. Age 39.	History of haemoptysis, half eggcupful of blood, staining of sputum next morning. No cough or loss of weight, feels well. Evening temperature slightly above normal at first. Later normal.	Slight dullness at the summit of right apex. A few sibilant rhonchi at left apex. Breath sounds generally rough.	Slight narrowing of right apex. Mottling above right clavicle and in outer part of first interspace. Otherwise normal.
(14) W.D. M. Age 27.	Slight cough, poor appetite, loss of weight, tiredness. Evening temperature normal.	Hilus dimple second space, marked tonic contraction of trapezius and scaleni left apex, also to some extent of the sterno-mastoid and pectoralis major. Prolonged expiration left apex back and front. Harsh wavy breath sounds left side anteriorly second to fourth ribs.	Negative.
(15) J.E. M. Age 21.	Loss of weight and appetite for six months. Was kicked on right side of chest three months ago. Had acute pleurisy with effusion. Effusion aspirated two months ago. Evening temperature 100° to 102°.	Diminished expansion whole of right side. Dullness right side back and front well marked at base. Breath sounds weak generally right side and almost absent at base.	Left lung normal. On the right side there is evidence of collapse of the lung, the only part which has re-expanded fully being the central portion.

NEGATIVE SPUTUM CASES. (Continued)

<u>CASE.</u>	<u>HISTORY AND SYMPTOMS</u>	<u>SIGNS.</u>	<u>X-RAY.</u>
(16) G.G. M. Age 12.	Loss of weight. Evening temperature normal.	Marked dullness right apex to the second rib and slight dullness to the third and in right axilla. Dullness also posteriorly to the midscapular area. Bronchial breath sounds and V.R. plus plus.	Dense shadow inner halves of first and second anterior interspaces. Narrowing of the apex above the clavicle and haziness of the inner half.
(17) M.H.H. F. Age 40.	Slight cough, shortness of breath, slight loss of weight, tired feelings, anaemia. Evening temperature about 99.6	Marked hollowing above right clavicle. Wasting of sternomastoid and muscles in supra-spinous area. Narrowing of Kronig's isthmus on right side. Dullness above right clavicle to below the spine. râles at left base.	Narrowing of the right apex.
(18) J.A.H. M. Age 26.	Cough, fatigue, loss of weight, looks thin and worried. Evening Temperature 99.6 at first. Normal later.	Hollowing above and below right clavicle. Slight dullness to the second rib and to the midscapular area posteriorly.	Negative.
(19) S.M. M. Age 50.	Long history of cough, shortness of breath, loss of weight, fatigue. Evening temperature 99° to 99.6.	Bronchitis and emphysema. Slight dullness at left apex Kronig's isthmus right 2 $\frac{3}{8}$ " left 2 $\frac{1}{8}$ ".	Some peribronchial fibrosis, slight haziness of left apex.

NEGATIVE SPUTUM CASES. (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(20) E.P. F. Age 30.	Family history positive. History of pleurisy three months ago Cough since. Occasional hoarseness. Loss of appetite and weight. Fatigue. Pain in right side of chest. Evening temperature 99° to 100°.	Weak breath sounds at right base. No percussion changes.	Negative.
(21) W.P. M. Age 52.	History of bronchitis five years ago. Winter cough since getting gradually worse. Loss of weight, three years. Thick mucopurulent sputum. Dyspnoea fatigue. Evening temperature normal.	Indrawing of lateral intercostal spaces marked. Slight dullness right apex Hyper-resonant note elsewhere anteriorly. Widespread râles all over left side and at right base. Breath sounds harsh generally and obscured by râles.	Very dense hilus shadows both sides and peribronchial fibrosis passing out from both hila, especially upwards towards the apices.
(22) G.S. M. Age 56.	Cough, shortness of breath for 12 years, gradually getting worse. Sputum twelve months. Loss of weight one stone in two years. Tired at night for a year. Streaking sputum five times when in Sanatorium. Evening temperature 100° to 101° descending to normal.	Dullness and weak breath sounds at left base which became more marked. Slight dullness at left apex.	Definite mottling lower third of left lung; Increased hilus shadow chiefly on left side. Slight mottling at left apex. Subsequent photograph shows generalised density at the left base due to fluid.

NEGATIVE SPUTUM CASES. (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(23) H.S. M. Age 29.	Pleurisy seven years ago and slight haemoptysis before admission, slight cough and sputum, loss of weight, evening temperature normal.	Drooping of right shoulder. Hollowing above both clavicles, mostly right side. Slight dullness left apex above the clavicle. Breath sounds weak and harsh generally. Tidal percussion shows expansion in anterior axillary line right 1" left $1\frac{1}{2}$ "	Shows limitation of movement of right diaphragm, obliteration of cardio-diaphragmatic sinus. Marked increase of hilus shadow, both sides. Scattered well defined small nodules the size of a pea, on the right side from the clavicle to the diaphragm and on the left in the upper two anterior spaces. The left apex is decidedly hazy.
(24) F.T. M. Age 31.	Treated in a Sanatorium two years ago. Recently suffered from fatigue and sweating at nights. Slight cough and sputum. Evening temperature normal.	Hollowing above and below right clavicle. Slight dullness right apex back and front. Breath sounds harsh generally.	Right apex fails to light up as well as left. Photograph shows some contraction of right apex. Calcareous nodules at both hila. Slight increase of bronchial shadows chiefly on right side.
(25) A.L. M. Age 36.	Cough and sputum on winter for four years. Shortness of breath. Loss of weight and fatigue during last six weeks. Evening temperature normal.	Marked asymmetry, scoliosis, convexity to left in the mid-dorsal region. Dullness right apex back and front. Breath sounds harsh right side anteriorly. Harsh and weak left side. Weak both sides posteriorly. Some rhenchi both sides.	Shows increased in bronchial shadows both sides and haziness at right apex.

NEGATIVE SPUTUM CASES. (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(26) H.H. M. Age 49.	Cough, sputum, shortness of breath for four years, getting worse. Loss of weight, tired feelings, Evening temperature 99° to 100°.	Dullness right side anteriorly to the fourth rib and posteriorly to the inferior angle of the scapula. Expansion poor. indrawing of lateral intercostal spaces and epigastric pulsation. Superficial cardiac dullness absent. Lower borders of the lungs very low, and tidal percussion shows almost no expansion. The right side breath sounds are weak and obscured by rhonchi and squeaks. Left side harsh breathing.	Ossification of all costal cartilages. Increased hilus shadow and bronchial markings. No mottling. Posterior inter-apex than left and there is some haziness and reduction in width of this apex.
(27) T.P. F. Age 37.	Run down for two years. Cough for nine months. Loss of appetite, and weight 1½ stone. Slight sputum and shortness of breath. Evening temperature 99° to 100° (pre-menstrual).	Slight dullness left apex to second rib anteriorly. Kronig's isthmus right 1½" left 1¼". A few crepitations above the left clavicle. Breath sounds bronchial in type at left apex.	Normal.

NEGATIVE SPUTUM CASES (Continued)

<u>CASE</u>	<u>HISTORY AND SYMPTOMS</u>	<u>SIGNS.</u>	<u>X-RAY.</u>
(28) A. McG. M. Age 37.	Influenza and pneumonia six years ago. Getting worse since. marked dyspnoea. Cough. Four to six ozs. sputum daily. Poor appetite, lost three stone in weight. Temperature practically normal.	Marked flattening and contraction of whole of left side, and marked dullness lower border of left lung 2" higher than that of right. Medium crackling râles left side anteriorly and left axilla. A small area of bronchial breath sounds and broncho-phony above fifth rib, below the pectoral margin. Apex beat outside nipple in fifth space.	Heart pulled over to left, complete opacity of left apex, mottling of left lung most marked to the left of the heart shadow over the fourth rib. On the right side also there is an increase in the bronchial shadows with a few scattered clearly defined opaque nodules.

COMMENTS ON NEGATIVE SPUTUM
CASES.

Case 1. The history and signs in this case all pointed to Asthma. When in the Sanatorium he kept well, but on going on leave to stay with his brother he had a definite attack of Asthma, and on return there were still numerous rhonchi on both sides. He gave a history of an asthmatic attack every week when at home before admission, but he never had any during his period in the Sanatorium. Symptoms, signs and X-ray were all against tuberculosis.

Case 2. This case had previously had tuberculosis of the peritoneum. He also had shell-shock six years ago, and has had neurasthenia since. His symptoms of cough, sputum, streaking, pain in right side, night sweats, loss of weight, taken along with signs of slight dullness left apex and breath sounds weak from clavicle to third rib, slight dullness right side posteriorly from spine of the scapula to base, weak breath sounds at right base, point definitely to tuberculosis, probably both lungs. The only sign on X-ray is lagging of the right diaphragm, corresponding to defective expansion of base of right lung in anterior-axillary line. Here there are probably adhesions from an old pleurisy. This explains repeated attacks of pain in right side, which is also at times definitely tender on palpation.

Case 3. History of bronchitis since childhood. Asymmetrical chest. Signs of emphysema, dilated veins along costal margin, Breath sounds weak at right base, where friction heard by another physician. Slight dullness right base. Rhonchi heard

/both

both sides and mucous [^]rales left base. The X-ray appearances are probably entirely due to fibrosis secondary to chronic bronchitis, going on for many years. The evidence for tuberculosis is in loss of weight, pleurisy right base, and mottling right apex. X-ray shows diaphragm tucked up by adhesions, so that there has probably been recent pleurisy where he has had pain. The slightly raised temperature can be accounted for by this also.

Case 4. Physical signs and X-ray findings are positive in this case, but are compatible with old standing quiescent disease. Symptoms pointed to slight re-activity.

Case 5. Signs, X-ray and symptoms positive in this case. Slightly active disease.

Case 6. Signs and symptoms of bronchitis and emphysema, but X-ray shows definite evidence of enlarged glands at both hila and considerable excess of peribronchial thickening and some mottling at apices. There is probably old-standing arrested disease here. There is, however, no evidence of activity.

Case 7. The signs in the chest are probably due to old-standing bronchitis; the X-ray shows nothing definitely positive of tuberculosis, and tachycardia and slightly abnormal temperature are probably due to hyperthyroidism.

Case 8. Definite history of contact with open cases of Pulmonary Tuberculosis, father and brother. The signs and the X-ray were not in this case definite.

Case 9. If this case symptoms, signs, and X-ray were all /positive.

positive.

Case 10. The symptoms and signs appeared to indicate definite Pulmonary Tuberculosis. The X-ray, however, showed extra-ordinarily little for the amount of signs present, and as tubercle bacilli were absent from the sputum on each of twelve examinations, the balance of evidence seemed rather to be in favour of dilatation of the bronchioles on both sides.

Case 11. Symptoms in this case pointed to Pulmonary Tuberculosis, but signs were only slight. The X-ray, however, showed definitely small nodular opacities at both apices.

Case 12. Family history and symptoms in favour of Pulmonary Tuberculosis. Signs and X-ray positive in first left interspace.

Case 13. Patient complained of nothing but haemoptysis. The signs were slight at the right apex, and confirmed by X-ray.

Case 14. This patient looked like tuberculosis, and he had had recent symptoms. The signs appeared to indicate a lesion at the left apex, but the X-ray showed nothing definite.

Case 15. This was a definite case of pleurisy with effusion. Two pints of clear sterile fluid had been removed before admission. X-ray showed the outer half of right lung uniformly opaque from base to apex. Internal to this was a smaller zone of slight uniform opacity, and between this and mediastinum the normal appearance of healthy lung. There was also a horizontal area of uniform opacity above the right diaphragm. An exploring needle was introduced but no fluid found, and the pleura was exceedingly resistant to the passage of the
/needle.

Case No. 15. (Contd).

needle. It was concluded that the appearances were due to an organised exudate binding the visceral and parietal layers together in their outer half, and producing the dense uniform opacity like an effusion..

Case 16. This boy was feeling well. The signs and X-ray were however definite.

Case 17. Fresh symptoms, signs of old disease, right side, with some activity left base. X-ray showed definite contraction of right apex.

Case 18. This case was neurasthenic. He had, however, definite dullness right side, though the X-ray showed nothing except calcareous glands at hila.

Case 19. In this case emphysema and bronchitis seemed sufficient to account for his signs and symptoms.

Case 20. Recent pleurisy right side confirmed by physical signs of weak breath sounds right base. This was probably tubercular pleurisy.

Case 21. The symptoms, physical signs and X-ray were in this case all in favour of Chronic Bronchitis and emphysema, and there was no positive evidence of tuberculosis having become superadded.

Case 22.. The signs were chiefly basal and it was thought that he might be a case of bronchiectasis, but the X-ray and symptoms of fever, haemoptysis, and low blood pressure ¹⁰⁶ 70 were more in favour of tuberculosis. His subsequent death from
/haemoptysis

haemoptysis confirmed the latter diagnosis.

Case 23. Symptomatology, physical signs, and X-ray all in favour of a diagnosis of old standing fairly quiescent tuberculosis, with a slight recent outbreak of activity.

Case 24. The same signs had been present in this case two years ago. This fact taken along with X-ray photograph indicated an old standing probably healed disease. The symptoms complained of recently were due to some intercurrent affection.

Case 25. In this case there is evidence of Chronic Bronchitis, but not clear evidence of tuberculosis.

Case 26. Chronic Bronchitis and emphysema with tuberculosis probably superadded.

Case 27. This is a case where the physical signs and symptoms indicated Pulmonary Tuberculosis, but in whom the X-ray showed no definite sign. It is a good example of a type of case quite frequently seen. Symptoms and signs positive, but X-ray negative.

Case 28. In this case the symptoms, signs and X-ray were all in favour of tuberculosis; the only point against this diagnosis being that the tubercle bacilli were never found. He was, however, accepted as a case of tuberculosis.

A table is also appended of ten positive sputum cases. In all of these the symptoms and signs were fairly definite, and the sputum examination merely confirmed the diagnosis. The X-ray, however, was of value in showing up more definitely the extent of the lesion.

POSITIVE SPUTUM CASES.

CASE	HISTORY & SYMPTOMS.	SIGNS.	X-RAY
(1) H.W. M. Age 31.	Well until one month ago. Tired feelings then. Week later cough, spit, night-sweats. Lost 9 lbs. weight last three months. Poor appetite, hoarseness. Evening temperature 99° to 99.6	Hollowing above both clavicles and below right. Slight dullness above left clavicle and first left interspace. Slight dullness right base posteriorly and laterally. Breath sounds poor generally. Specially weak right base. Here inspiration higher pitched than normal. No prolongation of expiration. Increased vocal resonance right base and below nipple anteriorly. Tidal percussion shows diminished expansion right side laterally. Indrawing of interspaces at right base posteriorly and laterally. Definite laryngeal disease..	Left side practically normal except just below inner end of left clavicle where there are a few opaque nodules. On the right side is increased density of the hilum and definite mettling of the lung below the third anterior rib to base, with two large opaque areas one $\frac{1}{2}$ " the other 1" in diameter.
(2) J.S.	Family history positive broncho-pneumonia sixteen months. Hoarseness occasionally for twelve months. Lacking in energy three months. Cough and sputum two months. Slight shortness of breath. Night sweats slight for two months. Streaking of sputum three weeks ago. Evening temperature 98.4° to 99.2.	Tonic contraction of muscles above left clavicle. Slight diminution of expansion left side. Narrowing of Kronig's isthmus left apex. Slight dullness left apex to second rib and resonance posteriorly not so high on left as on right. Breath sounds diminished second rib and harsh breath sounds second space. Crackling rales above clavicle. Tidal percussion shows good expansion both bases.	Fine mettling upper two thirds of left lung. On the right side mettling of coarser type in second interspace, with thickened band running outwards from hilum along the third rib.

POSITIVE SPUTUM CASES (Continued)

CASE	HISTORY AND SYMPTOMS	SIGNS	X-RAY.
(3) W.K. M. Age 27.	Family history positive. In a Sanatorium four years ago. Well since until five months ago, when he had haemoptysis. Cough and sputum and tired feelings for last three months. Night sweats recently. Slight loss of weight. Evening temperature 99.0 to 99.4.	Marked hollows above and below both clavicles. Slight dullness right side to the third rib and at right base posteriorly. Kronig's isthmus 2" right 2 1/4" left. Tidal percussion shows defective expansion right base posteriorly. Breath sounds are weak and harsh both sides.	Widespread mottling of whole of right lung with three opaque areas about the centre in the lower half about the size of a sixpence. Increased hilus shadow left side. Left apex hazier than right.
(4) A.W. F. Age 19.	Family history positive. Two years ago bronchitis and pleurisy. Cough, sputum, dyspnoea, night sweats, fatigue. Pain in chest. Evening temperature 100°. Occasional periods of fever 101° to 103°.	Drooping of right shoulder. Wasting right sterno-mastoid and trapezius. Flattening right side of chest below clavicle and diminished expansion. Slight dullness right apex anteriorly. Dullness apex to base posteriorly most marked at base. Breath sounds harsh, with prolonged expiration and a few rhonchi right apex anteriorly. Prolonged expiration and slightly harsh breath sounds left apex. Breath sounds at level of and below inferior angle scapula faint but bronchial. Coarse and sharply defined crepitations right base.	Dense opacity inner half of right base from the diaphragm upwards for two interspaces with a large oval clearer area in upper portion. Hilus shadow increased both sides with slight mottling extending up therefrom to the clavicles.

POSITIVE SPUTUM CASES (Continued)

CASE.	HISTORY AND SYMPTOMS.	SIGNS.	X-RAY.
(5) F.B. F. Age 20.	Cough on and off for two years. tired feelings for a few months. Slight sputum, slight loss of weight, slight haemoptysis. evening temperature 99° to 100°.	Slight droop of the left shoulder. Slight hollowing above and below left clavicle, slight dullness above and over left clavicle and above scapular spine. Kronig's isthmi equal. Breath sounds rough first interspace left side and weak at right base.	Increase of both hilus shadows with prolongation upwards to the clavicles on the left side.
(6) W.P. M. Age 33.	Poison gas six years ago. Hospital for nine months. Cough and shortness of breath, and sometimes sputum since. Haemoptysis twice, four years ago, one pint; eight weeks ago one gill. Lost a stone in five years. Evening temperature 98.4° to 99.2°	Poor expansion on right side. Drooping of right shoulder. Flattening of right supraspinous area. Dullness above and over right clavicle. Kronig's isthmus $1\frac{1}{2}$ " left side $2\frac{1}{8}$ " high. Right base 1" higher than left. Right side posteriorly slightly dull. Breath sounds weak generally on the right side most marked at base posteriorly. A few rales in right infra-axilla. Tidal percussion in anterior axillary line, right 0", left 1".	Right lung field considerably smaller than left. Right diaphragm raised. Dense homogeneous hilus shadow right side. Obliteration of the right cardio-diaphragmatic sinus. Hazy-ness of right apex above the clavicle. Few small opaque nodules in the second interspace.

POSITIVE SPUTUM CASES (Continued).

CASE	HISTORY AND SYMPTOMS	SIGNS.	X-RAY.
(7) E.F. F. Age 29.	Family history. Numerous Haemoptyses during the last six years. One pint a year ago and smaller quantities since on two occasions. Cough sputum, dyspnoea. Loss of weight two stones in three years. Night sweats. Tired feelings. Evening temperature 99.4° to 102°. Very variable. Had numerous haemoptyses during four months period of treatment, generally a few ozs at a time.	Slight dullness right apex to second rib and posteriorly to inferior angle of scapula. Breath sounds weak generally especially at right apex. A few crepitations heard occasionally in this area.	Increase of hilus shadow. Several small discreet opaque areas above left clavicle. Larger opaque area size of a threepenny piece just below inner end of left clavicle. Left hilus shadow also is continuous with this area. Right apex narrower than left with a few discreet opaque areas here also but smaller and less numerous than the opposite side.
(8) M.S.R. F. Age 20.	History of pleurisy a year ago. Haemoptysis three ozs. six days before admission. Feeling quite well. Evening temperature practically normal.	Slight dullness left side from the clavicle to the third rib, Kronig's isthmus right 1 7/8" left 1 3/4". Tidal percussion in anterior axillary line shows an expansion of 1" right 9/8" left. Posteriorly right 1 1/2", left 1 1/4" Dullness below inferior angle of scapula left base. Rales from midscapular area to base and in left infra-axilla. In lower third of left inter-scapular area there is prolonged expiration and increased vocal resonance.	Nothing definite. Prominent well developed mammae obscuring the condition in the lungs.

POSITIVE SPUTUM CASES (Continued)

CASE	HISTORY & SYMPTOMS.	SIGNS.	X-RAY.
(9) R.L. M. Age 24.	Family history pleurisy eight years ago. Haemoptysis half pint four months ago. Cough, sputum, night sweats, loss of weight, stone in four months. Shortness of breath two months. Evening temperature generally normal, occasional rises to above 99° as high as 99.8° on two occasions.	Drooping of right shoulder. Dullness to right apex and scapular spine. Crackling râles both apices. Prolonged expiration both apices. Inspiration weak left.	Increased density of hilus shadow. Mottling both apices as low as the second space.
(10) E.C. M. Age 23.	In Sanatorium five years ago. Feeling tired out for six months. Slight cough, morning sputum, slight shortness of breath, loss of weight, night sweats recent. Evening temperature 100° to 101°. Pulse 90 to 100.	Hollowing above both clavicles. Slight dullness at right apex to second rib and all of right side posteriorly and in right axilla. Breath sounds weaker right side behind. In front harsher, few fine crepitations from third rib anteriorly.	Very marked widening of both hilus shadows, especially the left, with prolongation upwards to the clavicles. Right apex narrower than left and hazier. Fine mottling scattered throughout both lungs.

COMMENTS ON EIGHT OF THE POSITIVE SPUTUM CASES.

Case 2. In case two, a lesion in the right lung at the level of the interlobar fissure was shown which had not been detected on physical examination. This is the type called by Barjon "Tuberculose Scissurale". Page 124.

Case 3. In case three, the X-ray shows up much more clearly than the physical signs, an extensive lesion of the right lung.

Case 4. In case four, the X-ray confirmed the presence of a cavity towards the base of the right lung where faint bronchial breath sounds had been heard.

Case 5. In case five, the physical signs and the X-ray gave slight signs confirming each other.

Case 6. In case six, the signs indicate partial collapse of the right lung, whilst the X-ray confirms this, at the same time showing a dense band passing down from hilum to the diaphragm, due, I think, to an old mediastinal pleurisy. There are also a few nodules due to an infiltration in second space.

Case 7. In case seven, the symptoms were more severe than the signs seemed to warrant, and the X-ray also showed very limited disease.

Case 8. In case eight, the symptoms and signs were positive whilst the X-ray showed nothing definite, but the area affected was the left lower lobe, which was obscured by very

/prominent

Case 8. (Continued)

prominent mammae

Case 10. Case ten was evidently an acute case from the symptoms, but tubercle bacilli were only found three times out of over twenty examinations, and the X-ray was of value in showing up much more widespread disease, than could be detected by physical signs.

My conclusions are as follows :-

1. That a complete and thorough collection of all relative data is essential.
2. That in suspected cases frequent examination of the sputum should be made, and that a decision against tuberculosis should not be made on one or two negative results.
3. That tubercle bacilli found in the sputum is the most certain sign of Pulmonary Tuberculosis.
4. That there are a large number of cases of Pulmonary Tuberculosis in whom tubercle bacilli cannot be demonstrated in the sputum.
5. That a critical attitude should be adopted towards negative sputum cases with long history of cough and sputum and well marked signs, especially auscultatory, of intra-pulmonary disease, if these are not corroborated by the X-ray.
6. That physical signs in early cases are sometimes present before the X-ray shows any abnormality.
7. That what are thought to be early cases from physical examination alone, are often shown by the X-ray plate to be by no means early.
8. That the X-ray plate in cases in whom the diagnosis is obvious on other grounds generally shows more extensive disease than the physical examination.

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